INEEL/EXT-01-01529
Revision 3

Field Sampling Plan for Groundwater Monitoring Under Operable Unit 10-08 for Fiscal Years 2002, 2003, and 2004

November 2002

Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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November 2002

Idaho National Engineering and Environmental Laboratory
Environmental Restoration Program
Idaho Falls, Idaho 83415

Prepared for the
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Approved by

11/13/02

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ABSTRACT

The purpose of this document is to direct the field sampling team in sampling efforts to support the OU 10-08 remedial investigation and to describe the number, type, and location of samples and the types of analyses. Information from this investigation will expand the baseline of groundwater information that will be used to develop a plan for future sitewide groundwater monitoring.

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ACRONYMS

AEC	Atomic Energy Commission
ALS	alpha spec
ARDC	Administrative Record and Document Control
ASTM	American Society for Testing Materials
BBWI	Bechtel BWXT Idaho LLC
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CO	Consent Order
COC	chain of custody
COPC	contaminant of potential concern
cpm	counts per minute
DAR	Document Action Request
D&D&D	deactivation, decontamination, and decommissioning
DCG	Derived Concentration Guides
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
DOT	Department of Transportation
DQO	data quality objective
EPA	Environmental Protection Agency
ER	Environmental Restoration
FFA	Federal Facility Agreement
FFA/CO	Federal Facility Agreement/Consent Order
FSP	Field Sampling Plan
FTL	field team leader

GC	gas chromatograph
GFP	gas flow proportional counting
G or P	glass or plastic
gpm	gallons per minute
HASP	Health and Safety Plan
HCl	hydrochloric
HDPE	high-density polyethylene
HRS	Hazard Ranking System
ICDF	INEEL CERCLA Disposal Facility
ID	identification
IDEQ	Idaho Department of Environmental Quality
IDW	investigation-derived waste
IH	industrial hygienist
INEEL	Idaho National Engineering and Environmental Laboratory
L&V	limitations and validation
LSC	liquid scintillation counting
MCL	maximum contaminant level
MCP	management control procedure
MS	matrix spike
MSD	matrix spike duplicate
NCP	National Contingency Plan
NPL	National Priorities List
O&MM	Operating and Maintenance Manual
ORP	oxidation reduction potential
OU	operable unit
PE	performance evaluation

PM	project manager
PPE	personal protective equipment
PQL	practical quantitation limit/level
QA	quality assurance
QAPjP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RDX	cyclotrimethylene trinitroamine
RI/FS	remedial investigation/feasibility study
RML	Radiation Measurements Laboratory
ROD	Record of Decision
RWP	radiological work permit
SAP	Sampling and Analysis Plan
SDA	Subsurface Disposal Area
SDG	Sample Delivery Group
SMO	Sample Management Office
SOP	standard operating procedure
SOW	Statement of Work
TBP	tributyl phosphate
TNT	trinitrotoluene
TPR	technical procedure
TRU	transuranic
TSA	Transuranic Storage Area
USGS	United States Geological Survey
VOA	volatile-organic analysis

VOC	volatile organic compound
WAG	waste area group
WERF	Waste Experimental Reduction Facility
WDDF	Waste Determination and Disposition Form
WGS	Waste Generator Services

Field Sampling Plan for Groundwater Monitoring under Operable Unit 10-08 for Fiscal Years 2002, 2003, and 2004

1. INTRODUCTION

1.1 Scope

The work described in this Field Sampling Plan (FSP) supports the Operable Unit (OU) 10-08 Waste Area Group (WAG) 10 remedial investigation/feasibility study (RI/FS) investigation under the Federal Facilities Agreement and Consent Order (FFA/CO) at the Idaho National Engineering and Environmental Laboratory (INEEL). The goals of the project are discussed in the RI/FS Work Plan (DOE-ID 2001b).

The Sampling and Analysis Plan (SAP) consists of two parts: this FSP and the *Quality Assurance Project Plan (QAPjP) for WAGs 1, 2, 3, 4, 5, 6, 7, and 10* (DOE-ID 2001). This FSP has been prepared in accordance with INEEL Environmental Restoration (ER) management control procedures (MCPs) and guidance from the U.S. Environmental Protection Agency (EPA) document, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988). This FSP describes the field activities that will occur and the QAPjP describes the processes and programs that ensure the data generated will be suitable for its intended use.

The purpose of this FSP is to guide the field team in the collection of groundwater samples on a regular, defined schedule from a limited number of boundary, guard, and baseline wells in fiscal years 2002, 2003, and 2004. The objectives of this investigation are discussed in detail in the WAG 10, OU-10-08 RI/FS Work Plan (DOE-ID 2002).

1.2 Idaho National Engineering and Environmental Laboratory Background

Located 42 mi west of Idaho Falls, Idaho, the INEEL occupies 890 mi^2 of the northwestern portion of the Eastern Snake River Plain (Figure 1-1). Comprehensive INEEL historical and geological information relevant to the INEEL is provided in the WAG 10, OU 10-08 RI/FS Work Plan (DOE-ID 2002).

1.3 Existing Data

The United States Geological Survey (USGS) has performed numerous environmental studies and investigations in and around the INEEL. Data from USGS wells and from USGS samples collected at OU 10-08 wells will be used along with the data generated during ER groundwater sampling activities. Additional discussion is available in the OU 10-08 RI/FS Work Plan (DOE-ID 2002).

1.3.1 Identification of Data Gaps

The USGS and others have studied the hydrogeology of the INEEL for over 40 years. Groundwater studies specific to various facilities have been conducted since 1971. The OU 10-08 RI/FS Work Plan (DOE-ID 2002) provides a discussion of known and suspected contaminant sources and the plan to identify data gaps pertaining to groundwater.

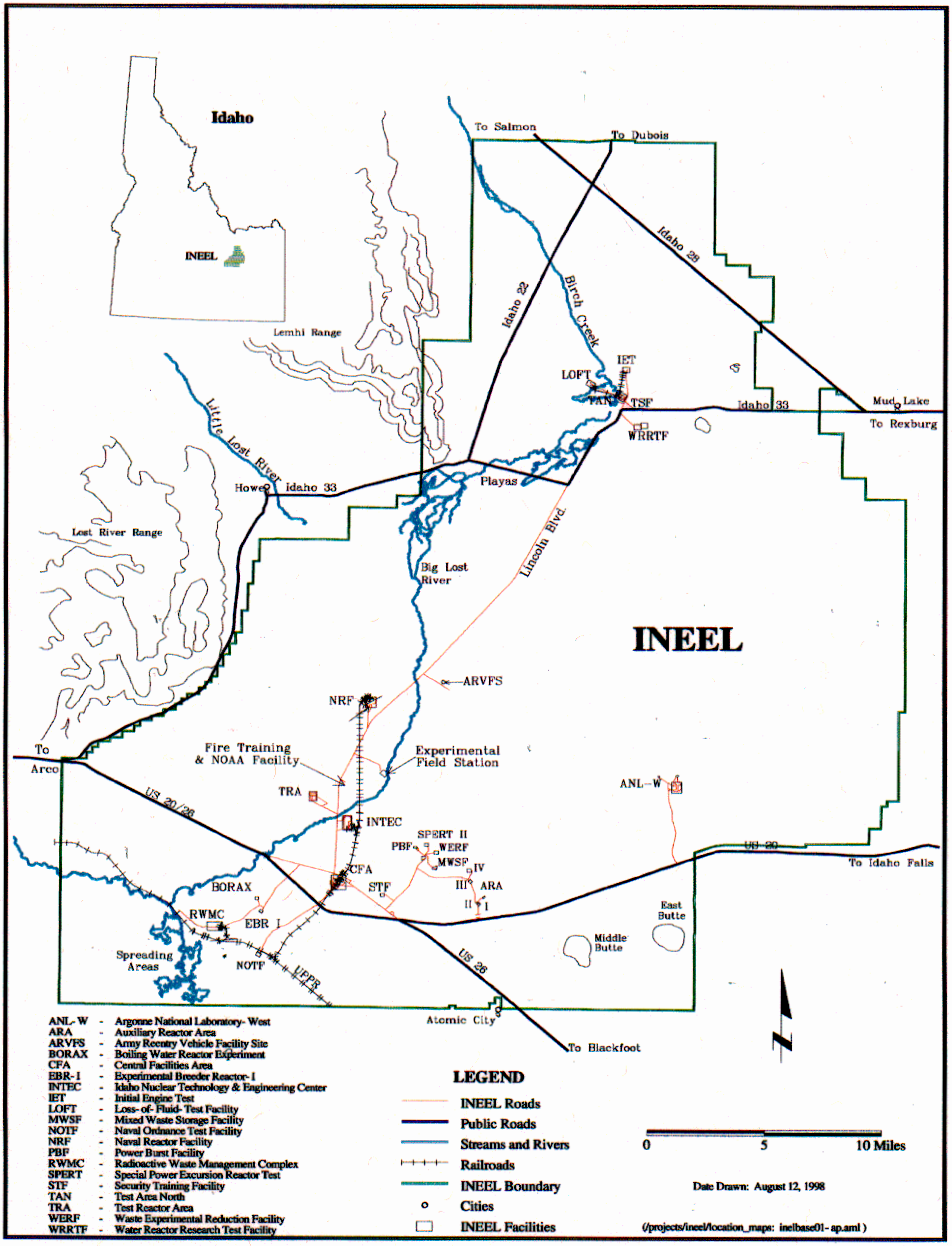

Figure 1-1. Map of the INEEL Site showing the locations of major facilities.

2. DATA USES

2.1 Data Quality Objectives

The data quality objectives (DQOs) for the OU 10-08 groundwater sampling are contained in the RI/FS Work Plan (DOE-ID 2002).

During the DQO scooping process, the original directions and assumptions identified for OU 10-08 in the OU 10-04 Work Plan (DOE-ID 1999) are still considered valid. These directions and assumptions are:

- Historical groundwater data would be consolidated and reviewed to eliminate the need for collecting new data to the extent practicable.

- The groundwater data previously obtained for other site activities are of sufficient quality to support the OU 10-08 RI/FS decision process.

2.2 Action Levels

The analytes and action levels for the guard, baseline, and boundary wells are listed in Table 2-1. The sampling and analysis plan (SAP) tables, included as Appendix B of this document, show the wells to be sampled and the laboratory analyses for each sample.

Table 2-1. OU 10-08 analytes and required quantitation levels.

Contaminant Type	Contaminant Name	Action Level and/or MCLs[c]	PQL Required (At least 1/2 MCL)	Analytical Method
Organics:	Carbon Tetrachloride	0.005 mg/L	0.001 mg/L[d]	All via USEPA
(Volatile organic compounds)	cis-1,2-Dichloroethene (cis-1,2-DCE)	0.07 mg/L	0.01 mg/L[d]	
	Methylene Chloride (Dichloromethane)	0.005 mg/L	0.001 mg/L[d]	Method 8260-B
	Tetrachloroethylene (PCE)	0.005 mg/L	0.001 mg/L[d]	
	Trans-1,2-Dichloroethene (trans-1,2-DCE)	0.1 mg/L	0.001 mg/L[d]	Appendix IX Group
	Trichloroethene (TCE)	0.005 mg/L	0.001 mg/L[d]	
Inorganics: (Metals)	Arsenic (As)	0.05 mg/L	0.01 mg/L	e
	Beryllium (Be)	0.004 mg/L	0.0008 mg/L	e
	Cadmium (Cd)	0.005 mg/L	0.001mg/L	e
	Chromium (Cr)	0.1 mg/L (total)	0.01 mg/L	e
	Lead (Pb)	Action Level = 0.015 mg/L	0.003 mg/L	e
	Mercury (Hg)	0.002 mg/L	0.0002 mg/L	e
	Zinc	5 mg/L (SDWS[5])	0.020 mg/L	e
Other:	Nitrate (as Nitrogen)	10 mg/L	2 mg/L	f
	TNT[a]	0.1 mg/L[i]	0.05 mg/L	USEPA Method 8330
	RDX[b]	0.03 mg/L[i]	0.015 mg/L	USEPA Method 8330
Radionuclides:	Gross Alpha	15 pCi/L - Total	4 pCi/L	GFP[g]
	Gross Beta (manmade)	Not to exceed 4 mrem/yr to the whole body or any organ	25 pCi/L (1/2 the screening level of 50)	GFP
	Gamma emitters (Cs-137)	200 pCi/L - Total	100 pCi/L	Gamma Spec.
	Uranium (U)	0.030 mg/L - Total	—	USEPA Method 908.0, 908.1

Table 2-1. (continued)

Contaminant Type	Contaminant Name	Action Level and/or MCLs[c]	PQL Required (At least 1/2 MCL)	Analytical Method
Radionuclides: (continued)	Iodine-129 (I-129)	1 pCi/L	0.1 pCi/L	LSC[h]
	Strontium-90 (Sr-90)	8 pCi/L	1 pCi/L	GFP
	Carbon-14 (C-14)	2,000 pCi/L	1,000 pCi/L	LSC
	Technetium-99 (Tc-99)	900 pCi/L	10 pCi/L	GFP; LSC
	Tritium (H-3)	20,000 pCi/L	400 pCi/L	LSC

a. TNT = trinitrotoluene

b. RDX = royal demolition explosive

c. MCL = Maximum contaminant level.

d. Practical quantification limit/level (PQL) based on 25 mL sample volume.

e. Via USEPA Document No. EPA-600/4-79-020 and/or EPA-600/R-04/111 Methods in conjunction with INEEL ER-SOW-156 specifications for Sample Delivery Group (SDG) Type 1C data.

f. Via American Society for Testing and Materials (ASTM) Standard Method D 3867-90 (Method A or B), Standard Method Part 4500- NO3 (Method D, E, F), or USEPA Method 300.0 (Revision 2.1) or 353.2 (Revisions 2.0), in conjunction with INEEL ER-SOW-156 specifications for SDG Type-3 data.

g. GFP = Gas flow proportional counting.

h. LSC = Liquid scintillation counting.

i. Based on "1 in 10,000" Risk-based action levels from the EPA Integrated Risk Information Service.

3. SAMPLING LOCATION, FREQUENCY, AND MEDIA

The general categories of wells identified for sampling under this FSP include:

- Downgradient boundary wells
- Downgradient guard wells
- Upgradient baseline wells

These general categories of wells have been listed in order of sampling priority. The downgradient boundary wells and guard wells are considered the most important to fill data gaps. The priority for filling data gaps reflects the goal of compliance with MCLs and cumulative risk thresholds in the groundwater from INEEL-released contaminants whether on or offsite by 2095. The project will provide the field team with the necessary guidance to ensure the proper wells are sampled. The wells are presented in Table 5-1. The groundwater monitoring wells will be sampled at least annually as presented in the Work Plan (DOE-ID 2002) for the analyses shown in the Appendix B "Sampling and Analysis Plan Tables." Figures A-1 through A-3 in Appendix A show the locations of the monitoring wells to be sampled.

4. SAMPLE IDENTIFICATION

A systematic 10-character sample identification code will be used to uniquely identify all samples. The uniqueness of the number is required for maintaining consistency and ensuring that no two samples are assigned the same identification code. In addition, the sample identification code identifies the WAG conducting the sampling, the sample type, if the sample is a duplicate, and the code's two-letter suffix (analysis code) can be used to identify the requested analysis for each sample. The Sample Management Office (SMO) assigns the sample numbers. The Integrated and Environment Data Management System is used to ensure the uniqueness of sample identification.

5. SAMPLING EQUIPMENT AND PROCEDURES

Sample collection is discussed in Section 5.1. The groundwater monitoring wells, listed in Table 5-1, will be sampled for the analyses shown in the Appendix B SAP table. When possible, sampling will be coordinated with USGS personnel.

5.1 Sample Collection

5.1.1 Site Preparation

All required documentation and safety equipment will be assembled at the well sampling site, including, radios, fire extinguishers, personal protective equipment (PPE), bottles and accessories.

Before sampling, all sampling personnel are responsible for having read both the SAP and the corresponding HASP (INEEL 2002). The field team leader (FTL) will perform a daily site briefing to discuss potential hazards and ensure that all personnel have the required training. The FTL will assign a team member to maintain document control and note this appointment in the WAG 10 groundwater sample logbook per TPR-4910 (Logbook Practices for ER and D&D&D Projects).

All sampling equipment that comes in contact with the sample media will be cleaned following Technical Procedure (TPR)-6541, "Decontaminating Sampling Equipment." The exception to this will be dedicated submersible sampling pumps. Sampling manifolds will be either decontaminated prior to bringing them to the field or decontaminated following use in each well before using them on another well.

5.1.2 Field Measurements

Initially, the field team will establish the work control zone as indicated in the HASP (INEEL 2002), don the appropriate PPE, and measure the depth to water. The water level data are used to determine the volume of water that must be purged before sampling. The field team will measure water levels at each well before purging using either an electronic measuring device or a steel tape measure. In addition, the field team will record the barometric pressure at each well at the time water level depths are determined. A post-sampling water level measurement is not required. In addition to the water level measurement, the field team will also measure the height from the depth-to-water measuring point to the top of the well casing and the stickup of the well casing either above the ground surface or the well pad. Field procedures for measuring water levels in wells are included in TPR-6566, "Measuring Groundwater Levels."

Table 5-1 shows the primary wells that will be sampled. The project will supply the field team with the necessary well completion data, and the field team will calculate the purge volume based on the current water level and will record all calculations on the well purging data form. The project will supply the field team with the approximate past purge volume as a crosscheck.

An inline flow meter may be attached to the sampling apparatus before purging to provide an accurate indicator of the pumping rate. If used, the portable inline flow meter will be attached "downstream" of the sampling port, so decontamination of the flow meter assembly between wells does not occur. The pre-purge flow meter reading will be recorded on the well purging data form so that the total volume purged can be recorded upon sample completion. If an inline flow meter is not used, then the purge water flow volume will be measured using a measured bucket and a watch to measure the approximate flow rate. This will measure the amount of time it takes to fill a specific volume of the bucket (ex: one or five gallons).

Table 5-1. Specific well information.

Well ID	Primary Wells	Screened Interval[a]	Northing[b]	Easting[b]	Depth to Bottom (ft)	Pump Depth (ft)	Approx. Depth to Water
	Boundary Wells						
450	USGS-001	600B630	650509.14	335610.808	635.7	612	588
458	USGS-009	620B650	654491.92	258101.051	654.1	635	607
535	USGS-086	Open	667053.21	243371.419	691	678	649
550	USGS-101	750B865	686264.547	374809.428	865	790	771
552	USGS-103	Open	652206.339	295938.213	760	700	583
554	USGS-105	Open	651355.361	277395.306	800	700	670
557	USGS-108	Open	650807.007	285611.423	760	637	609
558	USGS-109	600B800	651255.188	265735.781	800	656	621
559	USGS-110	580B780	652325.738	321866.503	780	612	566
183	HIGHWAY 2	741B786	687427.66	411631.14	786	no pump	725
	Guard Wells						
184	HIGHWAY 3	680B750	687065.16	277159.41	750	567	538
451	USGS-002	675B696	688843.68	352631.521	704	683	659
553	USGS-104	550B700 Open hole	662584.669	295915.137	560	592	555
555	USGS-106	605B760 Open hole	669059.406	280993.981	760	609	584
556	USGS-107	270B690 Open hole	667130.881	307797.235	690	531	477

Table 5-1. (continued).

Well ID	Primary Wells	Screened Interval[a]	Northing[b]	Easting[b]	Depth to Bottom (ft)	Pump Depth (ft)	Approx. Depth to Water
	Baseline Wells						
453	USGS-004	285B315 Perforated	771126.166	419184.76	553	303	251
		322B553 Open hole					
457	USGS-008	782B812	678015.33	226141.02	812	801	766
468	USGS-019	639B705	756882.924	288826.869	401	322	276
474	USGS-025	285B320	812272.22	347254.46	320	no pump	272
475	USGS-026	232B267	803222.19	369554.53	266.5	255	212
476	USGS-027	250B260 Perforated	782870.402	401830.07	312	262	228
		298B308 Perforated					
147	DH-1B	380 Open	767163.757	320726.773	400	no pump	268
250	P&W-3	322B401	818797.24	350802.53	406	no pump	304

5.1.3 Well Purging

The field team will use TPR-6570, "Sampling Groundwater," and specific well information to calculate purge volumes. Waste management is discussed in Section 9.

During the purging operation, the field team will use the Hydrolab (DataSonde® or MiniSonde®) or an equivalent instrument to measure the purge water for specific conductance, pH, dissolved oxygen, and temperature. If the system allows for measurement of oxidation reduction potential (ORP), then that data will also be collected. The field team will complete a functional check on the Hydrolab (or equivalent instrument) per instructions in the manufacturers manual. If there are extremes in temperature, the FTL may determine that a functional check should be performed more frequently. The factory-provided operating manual will be followed when using the Hydrolab DataSonde, MiniSonde, or equivalent system.

Per TPR-6570, the field team will collect initial readings for specific conductance, pH, dissolved oxygen, temperature, and flow rate just after purging begins and at regular intervals thereafter. All Hydrolab (or equivalent instrument) readings will be recorded on the well purging data form. The flow rate will be recorded in the WAG 10 groundwater sample logbook. There is also space on this form to record readings for total dissolved solids (65% of the conductivity reading). The water parameter readings will provide a check on the stability of the water sampled over time.

Following purging and collection of field measurements in compliance with TPR-6570, groundwater samples will be collected. Table 5-2 outlines the specific requirements for containers, preservation methods, sample volumes, and holding times for these analyses. Special requirements for volatile organics are included in TPR-6570. The samples collected for metals analysis will be filtered during sample collection. The preferred order for water sample collection is covered in TPR-6570.

Table 5-2. Specific groundwater sample requirements for routine monitoring.

Analytical Parameter	Container Size	Container Type	Preservative	Holding Time[a]
Volatile organics (VOA[c]) (SW-846-8260B)	40 mL	3 glass vials w/teflon septa	4°C and H_2SO_4 to pH <2	14 days
2,4,6-trinitrotoluene (TNT)	1 L	Amber glass	Cool 4°C	B
Cyclonite (RDX)	1 L	Amber glass	Cool 4°C	B
Total Metals—filtered CLP list	1 L	G or P[d]	pH <2, HNO_3	6 months, Hg 28 days
Nitrate (as nitrogen)	500 mL	G or P	H_2SO_4 to pH <2	14 days[g]
Tritium (H-3)	125 mL	1 HDPE	None	6 months
Gamma spectroscopy analysis	1 – 2 L	1 – 2 HDPE	pH <2, HNO_3	6 months
Gross alpha/beta; Sr-90; Am-241	3 L	3 HDPE or 1 cubitainer	pH <2, HNO_3	6 months
C-14	1 L	HDPE	None	6 months
Tc-99	1 L	HDPE	HNO_3 to pH <2	6 months
I-129	1 L	Amber glass or HDPE	None	28 days[e] 180 days[f]

a. Holding times are from date of collection as referred to in Federal Register Vol. 49, No. 209, October 26, 1984.

b. Collection to extraction: 7 days. Extraction to analysis: 40 days.

c. VOA = Volatile organic analysis.

d. G or P = Glass or plastic.

e. 28 days in high-density polyethylene (HDPE).

f. 180 days in amber glass.

g. Holding time per "Methods for Chemical Analysis of Water and Wastes," Environmental Protection Agency-600/4-79-020, March, 1983, page xix.

Aqueous organics: need to collect one sample in triplicate volume for each analysis.

6. SAMPLE HANDLING, PACKAGING, AND SHIPPING

After groundwater samples are collected from the well, the gloved sampling technician wipes the bottles to remove residual water and places them in the custody of the designated sample custodian. The sample custodian/shipper is responsible for ensuring that clear tape is placed over bottle labels, lids are checked for tightness, parafilm (excluding VOA samples) is placed around lids, and samples are bagged and properly packaged before shipment. Additional information is found in MCP-244, "Chain of Custody, Sample Handling, and Packaging for CERCLA Activities."

6.1 Field Screening

Groundwater samples have been collected periodically from INEEL wells for several decades. The laboratory results from all of these samples show that the samples are orders of magnitude below the Department of Transportation (DOT) classification of radioactive material. Based on the process knowledge from the previous monitoring results and the fact that all samples are collected from wells outside the facility fences, neither a field sample radiation screen nor a laboratory shipping screen will be required for these groundwater samples.

6.2 Sample Shipping

Samples will be transported in accordance with the regulations issued by the DOT (49 Code of Federal Regulations [CFR] Parts 171 through 178) and EPA sample handling, packaging, and shipping methods (40 CFR 261.C.3C.3). Additional information is found in MCP-244. All samples will be packaged and transported to protect the integrity of the sample and prevent sample leakage.

Upon receipt, laboratory personnel will check the temperature of each batch of coolers per their contract. The laboratory will communicate these temperatures to field personnel, and to the project through SMO, to ensure adequate coolant is used to cool the samples during shipment (if cooling is required). In addition, the laboratory will communicate any other discrepancies, such as broken samples or loss of chain-of-custody, to the project through the SMO. The project will determine the appropriate corrective action case-by-case.

7. DOCUMENTATION

The elements of sample documentation covered in this section are covered in additional detail in the *Quality Assurance Project Plan (QAPjP) for WAGs 1, 2, 3, 4, 5, 6, 7, and 10* (DOE-ID 2001). The FTL or designee is responsible for controlling and maintaining all field documents and records and for ensuring that all required documents are submitted to the Administrative Record and Document Control (ARDC) coordinator.

Field changes requiring document revision will be implemented by the FTL in accordance with the latest revision of MCP-135, "Creating, Modifying, and Canceling Procedures and Other DMCS-Controlled Documents." All entries will be made in permanent, nonsmearable black ink. All errors will be corrected by drawing a single line through the error and entering the correct information. All corrections will be initialed and dated. However, the nature of sampling activities is such that small variations from the FSP are occasionally required to complete the task. These small deviations in the procedures are a one-time event for which a document action request (DAR) is not necessary or desirable. These variations will be recorded in the WAG 10 groundwater sample logbook.

The serial number or identification (ID) number and disposition of all controlled documents (e.g., chain-of-custody [COC] forms) will be recorded in ARDC's document control logbook. If a document is lost, a new document will be completed. The loss of a document and an explanation of how the loss was rectified will be recorded in the document control logbook. The serial number and disposition of all damaged or destroyed field documents will also be recorded. All voided and completed documents will be maintained in a project file until completion of the sampling events, at which time all logbooks, unused tags and labels, COC copies, etc. will be submitted to ER SMO.

The following is a list of necessary field documents:

- COC forms
- WAG 10 Groundwater Sample logbook which will include shipping data, field instrument calibration/standardization logbook, visitor's sign-in, and field team leader notes and comments
- Quality Assurance Project Plan (controlled copy)
- Field Sampling Plan and attachments (controlled copy)
- Health and Safety Plan (controlled copy).

7.1 Field Documentation

7.1.1 Labels

A sample label will be used on each sample. Waterproof, gummed labels will be used. Labels may be affixed to sample containers before going to the field and completed on the actual sample date. The label will contain the sample collection time and date, preservation used, type of analysis, etc. Labels will remain in the custody of the FTL or his designee when not in use.

7.1.2 Chain-of-Custody Forms

The COC record is a multiple-copy form that serves as a written record of sample handling. When a sample changes custody, the person(s) relinquishing and receiving the sample will sign a COC record. Each change of possession will be documented. Thus, a written record tracking sample handling will be established. Additional COC information is found in MCP-244.

7.1.3 Logbooks

The Logbooks applicable to this project will be the WAG 10 Groundwater Sample logbook. TPR-4910, "Logbook Practices for ER and D&D&D Projects," in accordance with ARDC format will be used to record information necessary to interpret the analytical data. All information pertaining to sampling activities will be entered in the logbooks. Entries will be dated and signed by the individual making the entry. All logbooks will be quality control (QC) checked for accuracy and completeness by the FTL or designee.

The field team will use WAG 10 Groundwater Sample logbook as a sample shipping logbook. Each sample will be entered in the logbook. This logbook will be used to record the sample ID number, collection date, shipping date, COC number, cooler number, destination, sample shipping classification, name of shipper, and signature of person performing quality control (QC) check.

Each piece of equipment, as necessary, will have information and a record in the WAG 10 Groundwater Sample logbook on the calibration data. Team members will record information pertaining to the calibration of equipment used during this project.

Daily accounting of information related to this sampling project, including problems encountered, deviations from the SAP, and justification for field decisions will be recorded by the FTL in the WAG 10 Groundwater Sample logbook. This logbook will also double as a visitor's logbook.

The nature of sampling activities is such that variations from the procedures are occasionally required to complete the task. These small deviations in the procedures are a one-time event for which a DAR is not necessary. These variations will be recorded in the WAG 10 Groundwater Sample logbook.

Copies of the logbook pages will be sent to the project at the completion of each round of sampling.

7.1.4 Photographic Records

To verify the well condition, the field team will collect a digital photograph of the well site and well head condition before and after sampling.

7.1.5 Field Guidance Forms

The field team may use field guidance forms to facilitate sample container documentation and organize field activities. Field guide forms contain information on the sample request number, sample ID number, sample location, aliquot number, analysis type, container size and type, and sample preservation.

7.1.6 Waste Management Guidance

For each well, the field team will be provided documentation regarding the approximate purge volume and the required waste management options for the purge volume.

7.2 Project Organization and Responsibility

Specific individuals (as needed) will be assigned the following project positions during performance of the monitoring activities:

- Safety engineer
- Field team leader
- Radiological Control Technician (RCT)
- Industrial hygienist
- Quality engineers
- Facility manager and/or representatives
- SMO point of contact
- Administrative record and document control (ARDC) coordinator
- Radiological engineer
- Occupational Medical Program representative
- Project manager
- Project engineer
- Task lead.

With the exception of the SMO point of contact and the administrative record and document control coordinator, the Health and Safety Plan for the Environmental Restoration Sitewide Groundwater Monitoring (INEEL 2002) should be consulted for the overall organizational structure and specific personnel responsibilities. In addition to responsibility descriptions, the HASP ensures the implementation of occupational health and safety requirements.

8. WASTE MINIMIZATION

As part of the prejob briefing, an emphasis will be placed on waste reduction methods and personnel will be encouraged to continuously attempt to improve methods. No one will use, consume, spend, or expend equipment or materials thoughtlessly or carelessly. Practices to be instituted to support waste minimization include, but are not limited to the following. The project will:

- Restrict materials (especially hazardous material) to those needed for performance of work
- Substitute recyclable or burnable items for disposable items
- Reuse items when practical
- Segregate contaminated from uncontaminated waste
- Segregate reusable items such as PPE and tools.

9. HANDLING AND DISPOSITION OF INVESTIGATION DERIVED WASTE

All waste dispositioning will be coordinated with the appropriate Waste Generator Services (WGS) interface to ensure compliance with applicable waste storage, characterization, treatment, and disposal requirements.

The investigation-derived waste (IDW) produced during sampling will include spent and unused sample material, PPE, miscellaneous sampling supplies, decontamination water, purge water, and samples. The WGS will provide a determination for the disposition of all waste, including purge water, that is based on a waste determination and disposition form (WDDF). In addition to the WGS interface, Appendix G of the OU 10-08 RI/FS Work Plan (DOE-ID 2002) includes instructions for handling investigation-derived waste for this project.

Before sampling, the project will provide the field team with the WGS-generated WDDF for each well that describes the required disposal option for the purge water. Purge water from a majority of wells to be sampled under this FSP is anticipated to be eligible for release to the ground surface. In addition, to help ensure the purge volume is correct, the project will provide the samplers with the approximate volume of water that was purged from the well during a previous sampling round.

If, due to radionuclides, chemicals, or regulatory restrictions, the purged groundwater must be containerized for specific wells, then containerization will be done as long as a disposal option for the containerized purge water is available. If a purge water disposal option is not available, then WAG 10 will make a reasonable effort to find a disposal option before sampling the well and/or to reduce generation of this waste. For example, if the opportunity exists for those sites that have specific purge water disposal restrictions, the groundwater monitoring and sampling team will sample concurrently with other programs or WAGs to eliminate duplication and to provide for the most efficient and compliant management of purge water by those programs.

10. QUALITY

The objective of this investigation is to provide groundwater sample analytical data of sufficient quality and quantity to fill the data gaps identified in DOE-ID 2001b. This FSP is used in conjunction with the QAPjP (DOE-ID 2001). These documents present the functional activities, organization, and quality assurance/quality control (QA/QC) protocols necessary to achieve the specified DQOs. The QAPjP and the FSP together constitute the sampling and analysis plan for OU 10-08. Project-specific quality requirements not addressed in the QAPjP or elsewhere in this document are discussed in this section.

10.1 Quality Control Sampling

As outlined in the QAPjP (DOE-ID 2001), QA objectives are specified so that the data produced are of a known and sufficient quality for determining whether a risk to human health or to the environment exists. Minimum precision, accuracy, and completeness measurements and minimum detection limits are quantitative objectives specified in the QAPjP. Representativeness and comparability are qualitative objectives. During the sampling discussed in this plan field QC samples including field blanks, duplicates, and trip blanks will be collected and analyzed to evaluate the achievement of the precision and accuracy objectives specified in the QAPjP. The frequency of field QC sample collection will meet or exceed the minimum recommended number in the Table 10-1. Overall (field and laboratory) precision will be evaluated through the results of duplicate ground water samples, equipment rinsates, and field blanks. The duplicate samples, equipment rinsates, and field blanks will be analyzed for the same suite of analytes as the regular ground water samples. Trip blanks to be analyzed for volatile organic compounds (VOCs) will be included in each sample cooler shipped to the laboratory that contains VOC sample containers. The QA/QC samples to be collected and the planned analyses are also shown in Appendix B.

10.1.1 Performance Evaluation Samples

Environmental analyses are critical because decision-making based on inaccurate measurements or data of unknown quality can have significant economic and health consequences. To assess the accuracy and precision of the laboratory, performance evaluation (PE) samples will be added, if available, to sample delivery groups of ground water samples. The PE samples are spiked with known concentrations of radionuclides or chemicals in levels similar to those expected in the actual samples. Laboratory accuracy and precision will be evaluated based on their analytical results.

10.2 Quality Assurance Objectives

As outlined in the QAPjP (DOE-ID 2001), QA objectives are specified to ensure that data produced are of a known and sufficient quality. Minimum precision, accuracy, completeness requirements, and minimum detection limits are quantitative QA objectives specified in this plan or in the QAPjP. Representativeness and comparability are qualitative QA objectives.

10.2.1 Precision and Accuracy

The precision of the data will be qualitatively assessed based on the results of duplicate samples. Laboratory precision and accuracy are part of the data validation criteria against which the results are evaluated. In addition, as discussed in Subsection 10.1.1, PE samples will help quantify laboratory accuracy and precision. In general, bias (accuracy) in the field is difficult to assess and in this investigation it will be qualitatively evaluated based on the results of field and equipment blanks.

Table 10-1. Recommended minimum field QC samples.

Sample Type	Purpose	Collection	Documentation
Duplicate	Collocated sample collected to evaluate total measurement precision (cumulative precision error associated with field and laboratory operations)	Duplicates will be collected at a minimum frequency of 1/20 environmental samples or 1 per day, whichever is less.	Assign separate sample number
Field blank	Analyte-free water that is poured into a sample container at the sample collection site to check cross-contamination during sample collection and shipment[c]	**Radionuclides, VOCs, Metals** The recommended minimum frequency is 1/20 environmental samples or 1/day, whichever is less.	Assign separate sample number
Trip blank	Organic-free water in a vial sent from the laboratory to accompany VOC water samples during sampling and shipment processes. This blank is used for checking for cross-contamination during sample handling, shipment, and storage[a]	Trip blanks are for VOCs only. The recommended minimum frequency is 1/VOC cooler. To minimize the number of trip blanks, every effort should be made to include all VOC samples in one cooler and to minimize the number of VOC collection days.	Assign separate sample number

a. The water used for these blanks should be VOC analyte-free and can be obtained from a laboratory familiar with VOC analysis requirements. The SMO can arrange to supply the water if given 2 weeks notice prior to sampling. HPLC-grade water is acceptable for all field blanks except those collected for VOC analysis.

10.2.2 Minimum Detection Limits

The minimum detection limits for this project correspond to MCLs. In all cases, the contract-required quantitation limits and contract-required detection limits will be at least one half the MCL.

10.2.3 Critical Samples

Most of the proposed ground water samples are required to meet the project objectives; therefore, if ground water samples cannot be obtained, a determination will be made on a case-by-case basis as to whether an alternative well will be sampled.

10.2.4 Representativeness

The representativeness of the collected data will be evaluated by confirming whether the sampling methods were adhered to and DQOs were met.

10.2.5 Comparability

Data comparability will be assessed by evaluating the sampling procedures, sample handling, and laboratory analyses for each sample. If consistently applied for all samples, then the data are comparable.

10.2.6 Completeness

Completeness is the measure of the quantity of the usable data that have been collected during an investigation. A goal of 100% is to be achieved for critical samples.

11. DATA VALIDATION, REDUCTION, AND REPORTING

Data validation for the groundwater analytical data will receive Level A validation. Level A data validation is a thorough process done to evaluate subcontractor conformance to both contractual and technical criteria and is documented with a limitations and validation (L&V) report. The L&V report consists of data confirmation and data reduction, data clarification, and data appraisal. Data confirmation is the process of correlating the reported data within a given data package to its corresponding raw data. When applicable, this correlation also includes data reduction. Data reduction is the process of transforming raw data into reported data. This process includes the implementation of all applicable unit conversion calculations and data adjustment from techniques employed to dilute or concentrate samples. Data clarification is the process of qualifying or flagging reported analytical results, based on strict adherence to the applicable validation procedure and/or justifiable professional judgment by the data validator. Data appraisal is the formulation of a comprehensive L&V report that documents the entire method data validation process. The L&V report is written by an analytical chemist or other technical expert performing data validation. The report documents any deficiencies in the data, identified during the method data validation. A separate L&V report is required for each data package that undergoes method data validation. For each sample delivery group, a data limitation and validation report, which includes copies of COC forms, sample results, and validation flags, will be generated. All data limitation and validation reports will be transmitted to the EPA and Idaho Department of Environmental Quality (IDEQ) within 120 days from the last day of sample collection. All definitive data will be uploaded to the ground water sample analysis database.

12. REFERENCES

40 CFR 261, 2001, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations,* Office of the Federal Register, July 2001.

49 CFR Part 171, 2000, "General Information, Regulations, and Definitions," *Code of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 172, 2000, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements, *Code of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 173, 2000, "Shippers--General Requirements for Shipments and Packagings," *Code of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 174, 2000, "Carriage by Rail," *Code of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 175, 2000, "Carriage by Aircraft," C*ode of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 176, 2000, "Carriage by Vessel," *Code of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 177, 2000, "Carriage by Public Highway," *Code of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 178, 2000, "Specifications for Packagings," *Code of Federal Regulations,* Office of the Federal Register, October 2000.

54 FR 29820, 1989, "National Priorities List for Uncontrolled Hazardous Waste Sites," *Federal Register,* United States Environmental Protection Agency, pp. 29820-29825, July 14, 1989.

Bowman, A. L., W. F. Downs, K. S. Moor, and B. F. Russell, 1984, *INEL Environmental Characterization Report*, Vol. 2, EGG-NPR-6688, September 1984.

DOE-ID, 1999, Work Plan for Waste Area Groups (WAGs) 6 and 10, Operable Unit 10-04 Comprehensive Remedial Investigation/Feasibility Study (RI/FS), DOE/ID-10554, Rev. 0, April 1999.

DOE-ID, 2001, "Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites," DOE/ID-10587, Rev. 7, 2001.

DOE-ID, 2002, "WAG 10, OU 10-08, Comprehensive Remedial Investigation/Feasibility Study Work Plan," DOE/ID-10902, Rev. 0, March 2002.

EPA, 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA,* Interim Final, EPA.540.G-89/004, 1988.

EPA, 1983, *Methods for Chemical Analysis of Water an Wastes,* EPA-600/4-79-020, March 1983.

INEEL, 2002, "Health and Safety Plan for the Environmental Restoration Long-Term Stewardship Sitewide Groundwater Monitoring, Rev 0, INEEL/EXT-01-01644, 2002.

INEL, 1991, *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory*, December 1991.

INEL, 1995, *INEL Statement of Work for Organic Analyses Performed for the INEL Sample Management Office,* ER-SOW-156, Rev. 1, April 1995

MCP-135, "Creating, Modifying, and Canceling Procedures and Other DMCS-Controlled Documents," Rev. 12, General Administration and Information Management, May 2002.

MCP-244, "Chain of Custody, Sample Handling, and Packaging for CERCLA Activities," Rev. 4, Environmental Restoration, April 2002.

TPR-4910, "Logbook Practices for ER and D&D&D Projects," May 2002.

TPR-6541, "Decontaminating Sampling Equipment," June 2001.

TPR-6566, "Measuring Groundwater Levels," November 2000.

TPR-6570, "Sampling Groundwater," October 2000.

Appendix A

Field Sampling Plan for WAG 10 TRA Deep Vertical Profile Borehole Groundwater Sampling Under Operable Unit 10-08 for Fiscal Year 2003

Field Sampling Plan for WAG 10 TRA Deep Vertical Profile Borehole Groundwater Sampling Under Operable Unit 10-08 for Fiscal Year 2003

A1. INTRODUCTION

A1.1 Scope

The work described in this Field Sampling Plan (FSP) supports the Operable Unit (OU) 10-08 Waste Area Group (WAG) 10 Well Implementation Prioritization Plan Test Reactor Area (TRA) Deep Vertical Profile Borehole (Middle 1823) project and the Remedial Investigation/Feasibility Study (RI/FS) investigation under the Federal Facilities Agreement and Consent Order at the Idaho National Engineering and Environmental Laboratory (INEEL). The goals of the project are discussed in the RI/FS Work Plan (DOE-ID 2001b).

The Sampling and Analysis Plan (SAP) consists of two parts: this FSP and the *Quality Assurance Project Plan (QAPjP) for WAGs 1, 2, 3, 4, 5, 6, 7, and 10* (DOE-ID 2001). This FSP has been prepared in accordance with INEEL Environmental Restoration (ER) management control procedures (MCPs) and guidance from the U.S. Environmental Protection Agency (EPA) document, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988). This FSP describes the field activities that will occur to evaluate the vertical and horizontal extent of contamination along the assumed axis of the TRA plume throughout the aquifer southwest of TRA. The main FSP, *Field Sampling Plan for Groundwater Monitoring Under Operable Unit 10-08 for Fiscal Years 2002, 2003, and 2004* (INEEL 2002) provides information for the following:

- Sample identification
- Sample handling, packaging, and shipping
- Documentation
- Project organization and responsibility
- Waste minimization
- Quality
- Data validation, reduction, and reporting.

The purpose of this FSP is to guide the field team in the collection of groundwater samples during drilling of the new deep borehole south and west of the TRA facility in the fiscal year 2003. This borehole (the Hydrological Data Repository official name for this borehole is Middle 1823) is designed to further the characterization of groundwater chemistry through vertical profile sampling and to establish criteria for aquifer thickness by thermal profiling. For the purpose of this FSP, vertical sampling of Middle 1823 will include measuring depth-to-water in the borehole during each vertical profile groundwater sampling event, at the end of each weekly drilling shift, and at the start of the next week's drilling shift. It will also include measuring and recording field parameters such as pH, temperature, and specific conductance in the groundwater during purging. Sampling will also include collection of groundwater samples for specific analysis specified in this FSP, including field screening for hexavalent chromium using the CHEMetrics, Inc. field test kits. The objectives of this investigation are discussed in the WAG 10, OU-10-08 RI/FS Work Plan (DOE-ID 2002).

A1.2 INEEL Laboratory Background

Located 42 mi west of Idaho Falls, Idaho, the INEEL occupies 890 mi2 of the northwestern portion of the Eastern Snake River Plain (Figure 1-1). Comprehensive INEEL historical and geological information relevant to the INEEL is provided in the WAG 10, OU 10-08 RI/FS Work Plan (DOE-ID 2002). Location of Middle 1823 is approximately one mile south-southwest of the TRA facility (Figure 1-2).

A1.3 Existing Data

A1.3.1 Identification of Data Gaps

The United States Geological Survey (USGS) and others have studied the hydrogeology of the INEEL for over 40 years. Groundwater studies specific to various facilities have been conducted since 1971. The OU 10-08 RI/FS Work Plan (DOE-ID 2002) provides a discussion of known and suspected contaminant sources and the plan to identify data gaps pertaining to groundwater. Previous investigations at the INEEL have identified data gaps downgradient from the TRA facility. Data gaps include issues concerning fate and transport of contaminants of concern injected at the TRA injection well, lack of geochemical vertical profiling or characterization of the aquifer, and the potential INEEL groundwater contaminants of potential concern (COPCs) that may be present in the aquifer at this location. Other data gaps identified include the lack of stratigraphic control and active aquifer thickness for constraining the evolving site wide WAG 10 model, which is in progress. The Middle 1823 deep borehole project will assist in:

- Assessing the cumulative risk to human health and the environment for downgradient and off-site receptors
- Advancing knowledge of the aquifer geometry and geologic architecture within the INEEL and adjacent areas of influence concerning the Eastern Snake River Plain aquifer
- Filling data gaps in the OU 10-08 site-wide monitoring network for addressing sitewide issues concerning the vertical extent of contaminants in the aquifer beneath and downgradient of TRA, preferential flow paths, and contaminant transport
- Establishing criteria or baselines for addressing concerns from the lack of significant data about implications from geochemistry of the aquifer and aquifer thickness
- Adding data to the dynamic INEEL sitewide groundwater model in progress.

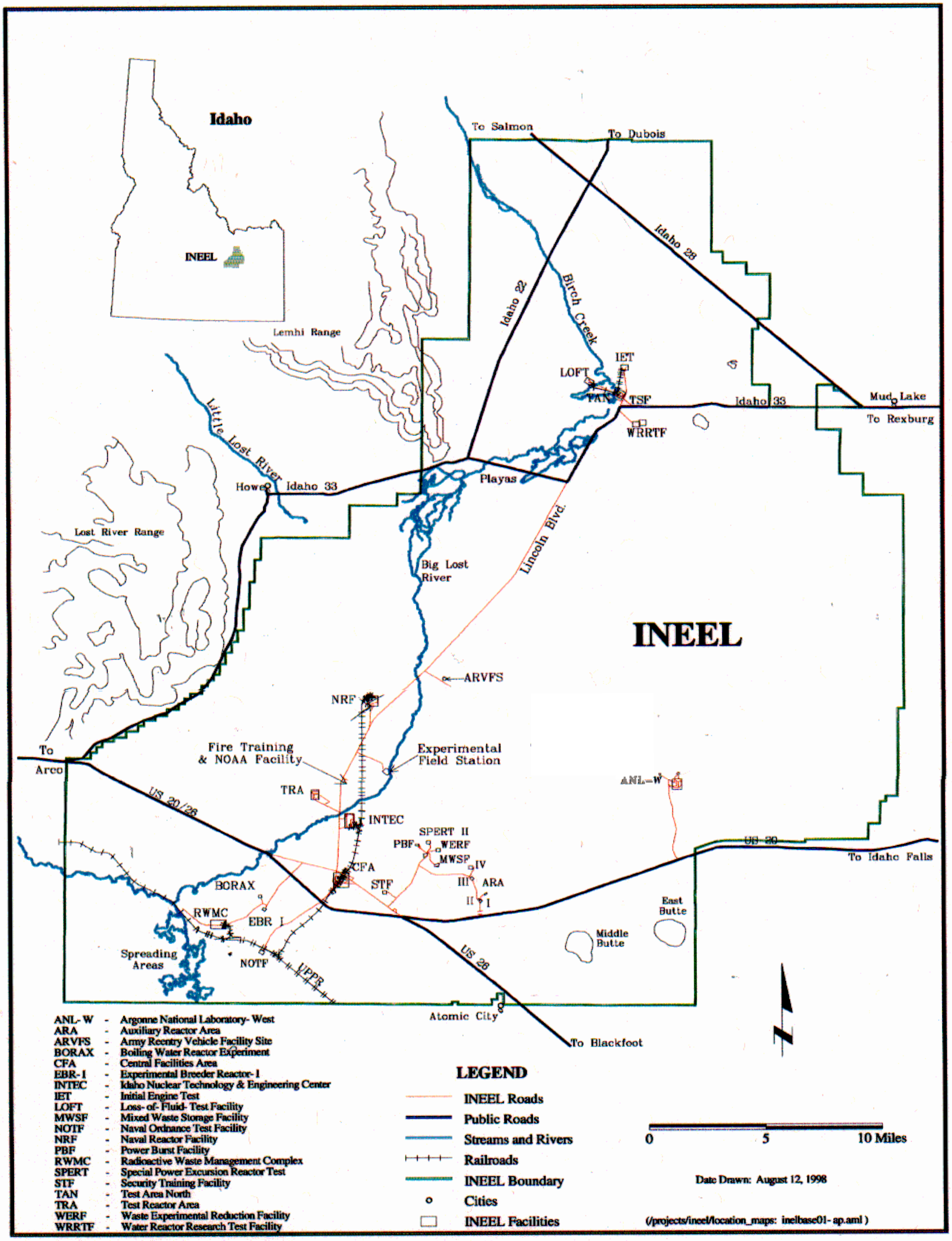

Figure A1-1. Map of the INEEL site showing the locations of major facilities. ..

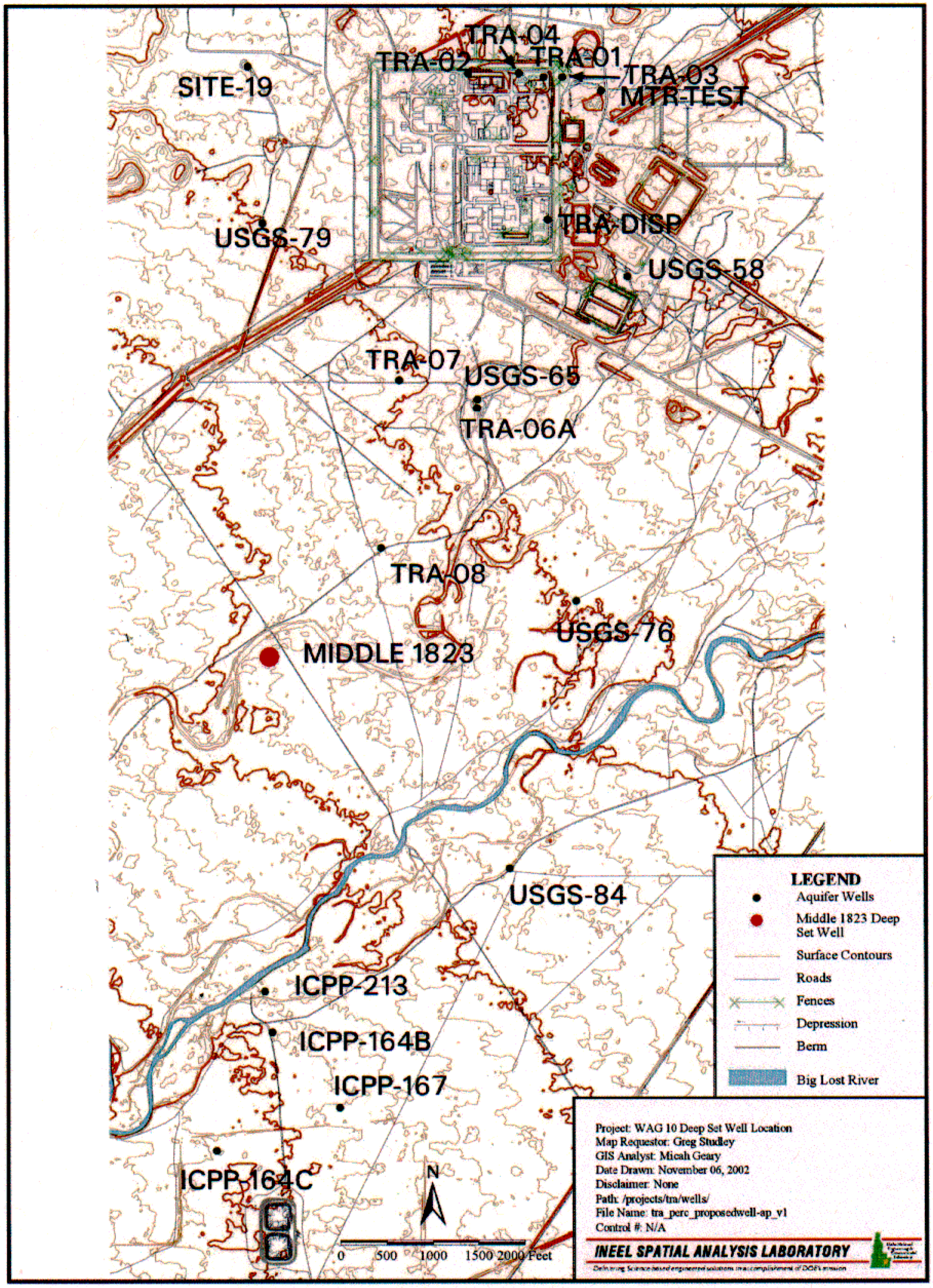

Figure A1-2. Map of the INEEL site showing location of Middle 1823.

A2. DATA USES

A2.1 Data Quality Objectives (DQOs)

The DQOs for the drilling and collection of vertical profile samples from the Middle 1823 deep vertical borehole is to define the vertical and horizontal extent of contamination throughout the aquifer southwest of TRA. Groundwater sampling and analysis will determine if INEEL-wide COPCs or contaminants from the TRA injection well are detected throughout the vertical extent of the aquifer from approximately 500 to 1,500 ft. Table A2-1 identifies the DQOs for Middle 1823.

A2.2 Action Levels

The analytes and action levels for the Middle 1823 are listed in Table A2-2.

Table A2-1. Data Quality Objectives Table, WAG 10 OU 10-08, Deep Vertical Profile Borehole – Middle 1823

1. State the Problem	2. Identify the Decision			3. Identify Inputs to the Decision	4. Define the Study Boundaries	5. Develop a Decision Rule	6. Specify Tolerable Limits on Decision Errors	7. Optimize the Design
Problem Statement	Principal Study Questions	Alternative Actions	Decision Statement					
Evaluate the vertical and horizontal extent of contamination along the assumed axis of the TRA plume in the aquifer southwest of TRA for INEEL-wide COPCs and for contaminants from the TRA injection well.	PSQ-1: Is there a groundwater contaminant plume that exceeds MCLs further downgradient of existing Well TRA-08 and downgradient of TRA?	AA-1: If there is a plume present downgradient, then additional downgradient investigation may be required.	DS-1: Determine if contamination in the vertical extent of the aquifer exceeds any of the MCLs for the COPCs.	Inputs if PSQ-1: 1. Drill a vertical profile well to the southwest and downgradient from TRA 2. Drill to a depth of approximately 1,500 ft bls, which is deeper than the depth of the TRA injection well, and take into account potential slope of the groundwater and contaminant migration downgradient from TRA. 3. Collect vertical profile water samples from the aquifer at approximate 100 ft intervals throughout the aquifer or at identified stratigraphic breaks, such as interbeds, rubble zones, or major fractures as determined by core logging.	Vertical profile sampling on a sitewide basis by WAG 10 is focused on investigating the active thickness of the aquifer primarily in the central and southern portions of the INEEL. The vertical profile sample boreholes will evaluate potential influx of natural and man-made contaminants through potential preferential pathways beneath the INEEL. The current borehole downgradient from TRA is designed to investigate potential INEEL-wide COPC contaminants, as well as TRA injection well contaminants throughout the thickness of the aquifer to 1,500 ft bls at this location southwest of TRA. The borehole will also collect the information the various aquifer parameters requested by Subject Matter Experts as detailed in Section #7,Optimize the Design, of this table.	DS-1: If chromium or tritium or other contaminants at concentrations greater than MCLs are detected in the groundwater aquifer southwest (downgradient) of TRA, then additional investigation or reevaluation of the TRA remedial design may be necessary.	Refer to QAPjP.	The current INEEL-wide groundwater data is sufficient to identify potential locations for new wells to obtain information to fill data gaps for understanding flow thickness and contamination in the aquifer. A deep vertical borehole southwest of TRA will be drilled and sampled to help fill data gaps to investigate the potential of contaminants in the aquifer for both INEEL-wide COPCs and TRA contaminants. The purpose of the drilling and sampling is to collect vertical profile groundwater samples of the aquifer to determine if contaminants are present in the aquifer at any of the intervals sampled by this borehole. The project requirements for the drilling and sampling of this deep vertical profile borehole to answer the PSQs are as follows: 1. Borehole Middle 1823 will be located in the regional downgradient direction approximately 1,800 ft from existing groundwater monitoring well TRA-08, and approximately 5,700 ft in the regional downgradient direction from the TRA disposal well. 2. The deep vertical profile borehole is proposed to be drilled to a total depth of 1,500 ft. 3. Drilling will be performed using reverse-circulation drilling techniques from the ground surface to the top of the aquifer at approximately 500 ft bls. 4. Drill cutting samples will be collected by the on-site field geologist and logged into the field logbook.
	PSQ-2: What is the vertical extent of contaminants in the aquifer downgradient from TRA?	AA-2: If there are contaminants in the deeper portions of the aquifer, then there may be a need to drill deeper.	DS-2: Determine the vertical distribution of contaminants in the aquifer.	Inputs to PSQ-2: Collection of groundwater samples via vertical profile sampling using a packer isolation system of the sample intervals to determine depth of potential contaminants.		DS-2: If in-well flow measurements in the bottom of the borehole indicate a sinking head, then a decision on continuing the borehole to a deeper depth may be necessary.		

Table A2-1. (continued).

1. State the Problem	2. Identify the Decision			3. Identify Inputs to the Decision	4. Define the Study Boundaries	5. Develop a Decision Rule	6. Specify Tolerable Limits on Decision Errors	7. Optimize the Design
Problem Statement	Principal Study Questions	Alternative Actions	Decision Statement					
	PSQ-3: What are the hydraulic controls (such as confining layers or vertical hydraulic gradients) that control the movement of potential contaminants in the aquifer downgradient from TRA?	AA-3: If hydraulic controls are identified from the borehole, additional drilling may be needed to define the controls.	DS-3: Determine the hydraulic controls in the aquifer.	Inputs to PSQ-3 1. Drill borehole using coring techniques from 500 to 1,500 ft bls unless high concentrations are detected at the bottom of the borehole. 2. Log borehole core for stratigraphic information. 3. Measurement for physical properties of core (mainly interbeds or rubble zones) for parameter, such as grain size analysis and saturated thickness. 4. Measurement of depth-to-water during drilling through significant stratigraphic zones of the entire borehole to assist in determination of variations in head conditions, such as upward flow. 5. In-well flow measurements.		DS-3: Borehole Completion Decision: 3a) If contamination is detected in the upper portion of the aquifer, then the borehole will be completed as a shallow monitoring well. 3b) If no contamination is detected in the aquifer and the borehole is stable, then leave the borehole open for future testing. 3c) If no contamination is detected in the aquifer and the borehole is not stable, then complete as a shallow monitoring well. 3d) If contamination is detected in the deeper portions of the borehole, then refer to 3b and 3c above, then drill an adjacent monitoring well that is completed to sample the depth of the detected contamination. 3e) If contamination (chromium or tritium) are detected at the bottom of the borehole (~1,500 ft bls), then continue to drill using core drilling techniques until contamination is no longer detected, then refer to 3b and 3c above.		5. Drilling will be performed using coring techniques from the top of the aquifer at approximately 500 ft bls to the current planned total depth of the borehole at 1,500 ft bls. 6. Use a PQ-sized (or reduced size, if necessary) corebarrel to collect intact interbed samples in lexan tubes for stratigraphic information. 7. Groundwater samples will be collected throughout the saturated vertical portion of the aquifer at approximate 100 ft intervals in the borehole. 8. At each sample depth, a portion of the groundwater collected will be utilized to measure the range of hexavalent chrome in the groundwater using a CHEMetric field test kit. The results of the test will be used for immediate information about concentrations of hexavalent chromium in the groundwater and the results of the test will be recorded in the field logbook. 9. Collect groundwater water quality parameters for the purgewater from each vertical profile aquifer sample interval to include pH, temperature, specific conductance, and water clarity. 10. Water level head measurements will be collected from the borehole during core drilling. Water level head measurements will be collected using an e-line. The water level measurements will be collected before and after each groundwater

Table A2-1. (continued).

1. State the Problem	2. Identify the Decision			3. Identify Inputs to the Decision	4. Define the Study Boundaries	5. Develop a Decision Rule	6. Specify Tolerable Limits on Decision Errors	7. Optimize the Design
Problem Statement	Principal Study Questions	Alternative Actions	Decision Statement					
	PSQ-4: Based on the results of PSQ-2 and PSQ-3, is the depth of a potential contaminant plume downgradient sampled by the deep vertical profile well deep enough to detect contaminants for the depth of the TRA injection well of 1,275 ft bls?	AA-4: Determine if contamination from the TRA injection well is deeper than the bottom of the vertical profile borehole. If high concentrations of COPCs are detected at the lowermost sample interval in the borehole, additional deeper drilling and sampling may be required. It may require remediation or revision of the TRA remediation goals.	DS-4: Based on the results of PSQ-2 and PSQ-3, determine if TRA injection well contaminants are in the deeper portions of the aquifer.	Inputs to PSQ-4: Outputs from PSQ-2 and PSQ-3.				vertical profile sampling event, and at the end of the drill shift on each Friday and at the beginning of each drill shift on each Monday, while drilling in the aquifer portion of the borehole. This data will be used to determine potential raising or sinking head information in the borehole. 11. The locations of vertical profile aquifer samples will be based on information gathered by logging of the drill core with emphasis on stratigraphic breaks in the drilled section, including interbeds, rubble zones, and major fractures. 12. Groundwater samples will be analyzed for volatile organic compounds, filtered and unfiltered metals, total uranium, nitrates, radionuclides, anions, and cations. 13. Geophysical logs will be run using the standard USGS geophysical suite, including natural gamma, gamma-gamma, neutron, video log, caliper measurements and borehole deviation measurements. 14. Fluid flow logging using the USGS flow meter and thermal measurements will be performed based on equipment and funding availability to complete these measurements. Thermal profiling will be utilized to determine geothermal gradients inflection points and aquifer thickness. 15. The completion of the borehole as a groundwater monitoring well will be based on the results of analysis of vertical profile groundwater samples. Note: Due to project budget limitations, all or parts of items #6, 10, 14, and 15 may not be performed or may be modified. These items may be performed by the Subsurface Science Group under separate funding.

Table A2-2. OU 10-08 Middle 1823 COPC analytes and required quantitation levels.

Contaminant Type	Contaminant Name	Action Level and/or MCLsa	PQL Required (at least 1/2 MCL)	Analytical Method
Organics:	Carbon Tetrachloride	0.005 mg/L	0.001 mg/L[b]	All via USEPA
(Volatile organic compounds)	cis-1,2-Dichloroethene (cis-1,2-DCE)	0.07 mg/L	0.01 mg/L[b]	
	Methylene Chloride (Dichloromethane)	0.005 mg/L	0.001 mg/L[b]	Method 8260-B
	Tetrachloroethylene (PCE)	0.005 mg/L	0.001 mg/L[b]	
	Trans-1,2-Dichloroethene (trans-1,2-DCE)	0.1 mg/L	0.001 mg/L[b]	Appendix IX Group
	Trichloroethene (TCE)	0.005 mg/L	0.001 mg/L[b]	
Inorganics: (Metals)	Arsenic (As)	0.05 mg/L	0.01 mg/L	c
	Beryllium (Be)	0.004 mg/L	0.0008 mg/L	c
	Cadmium (Cd)	0.005 mg/L	0.001mg/L	c
	Chromium (Cr)	0.1 mg/L (total)	0.01 mg/L	c
	Lead (Pb)	Action Level = 0.015 mg/L	0.003 mg/L	c
	Mercury (Hg)	0.002 mg/L	0.0002 mg/L	c
	Zinc	5 mg/L (SDWS[5])	0.020 mg/L	c
	Uranium (U)	0.030 mg/L - Total	0.015 mg/L Total	ALS[h]
Other:	Nitrate (as Nitrogen)	10 mg/L	2 mg/L	d
Radionuclides:	Gross Alpha	15 pCi/L - Total	4 pCi/L	GFP[g]
	Gross Beta (manmade)	Not to exceed 4 mrem/yr to the whole body or any organ	25 pCi/L (1/2 the screening level of 50)	GFP
	Gamma emitters (Cs-137)	200 pCi/L - Total	100 pCi/L	Gamma spec
	Iodine-129 (I-129)	1 pCi/L	0.5 pCi/L	LSC[f]
Radionuclides: (continued)	Strontium-90 (Sr-90)	8 pCi/L	1 pCi/L	GFP
	Technetium-99 (Tc-99)	900 pCi/L	10 pCi/L	GFP; LSC

Table A2-2. (continued).

Contaminant Type	Contaminant Name	Action Level and/or MCLsa	PQL Required (at least 1/2 MCL)	Analytical Method
	Tritium (H-3)	20,000 pCi/L	400 pCi/L	LSC
Additional Scientific Investigation Analysis				
Inorganics:	Hexavalent chromium, unfiltered and filtered			
	Total chromium, unfiltered			
	Silica			
	Strontium			
Alkalinity	Total			
	Hydroxide			
	Carbonate			
	Bicarbonate			
Anions	Chloride			
	Fluoride			
	Sulfate			

a. MCL = maximum contaminant level

b. Practical quantification limit/level (PQL) based on 25 mL sample volume

c. Via USEPA Document No. EPA-600/4-79-020 and/or EPA-600/R-04/111 methods in conjunction with INEEL ER-SOW-156 specifications for Sample Delivery Group (SDG) Type 1B data

d. Via American Society for Testing and Materials Standard Method D 3867-90 (Method A or B), Standard Method Part 4500- NO3 (Method D, E, F), or USEPA Method 300.0 (Revision 2.1) or 353.2 (Revisions 2.0), in conjunction with INEEL ER-SOW-156 specifications for SDG Type-3 data

e. GFP = gas flow proportional counting

f. LSC = liquid scintillation counting

g. Based on "1 in 10,000" risk-based action levels from the EPA Integrated Risk Information Service

h. ALS = alpha spec

A3. SAMPLING LOCATION, FREQUENCY, AND MEDIA

The deep vertical profile borehole identified for sampling under this FSP is OU 10-08 Middle 1823, the TRA deep vertical profile borehole. The project will provide the field team with the necessary guidance to ensure this deep borehole is properly sampled to establish the potential vertical extent of contaminants in the aquifer downgradient from the TRA facility. This borehole is being drilled and sampled in response to data gaps identified as part of the OU 10-08 RI process. Additional information on sampling is provided in Section A4.

A4. SAMPLING EQUIPMENT AND PROCEDURES

Sample collection for the TRA deep vertical borehole is discussed in Section A4.1.

A4.1 Sample Collection

A4.1.1 Site Preparation

All required documentation and safety equipment will be assembled at the well sampling site, including radios, fire extinguishers, personal protective equipment (PPE), bottles, and accessories.

Before sampling, all sampling personnel are responsible for having read the FSP, the SAP, and the corresponding Health and Safety Plan (HASP) (INEEL 2002). The field team leader (FTL) will perform a daily site briefing to discuss potential hazards and ensure all personnel have the required training. The FTL will ensure the latest Waste Determination and Disposition Form (WDDF) lists from Waste Generator Services (WGS) are available for review and have been reviewed by the field sampling crew prior to the start of groundwater sampling. The FTL will assign a team member to maintain document control and note this appointment in the WAG 10 groundwater sample logbook per Technical Procedure (TPR)-4910, Logbook Practices for ER and D&D&D Projects.

All sampling equipment that comes in contact with sample media will be cleaned following steps in TPR-6541, Decontaminating Sampling Equipment. The exception to this will be dedicated submersible sampling pumps. Sampling manifolds, if used, will either be decontaminated prior to bringing them to the field or decontaminated following use in each well before using them on another well.

A4.1.2 Technical Requirements For Field Measurements

WAG 10 management utilizing the nominal group technique of a DQO team evaluated the current state of knowledge for groundwater flow beneath the INEEL. They determined that in the approximate location of Middle 1823 additional subsurface and water quality data are needed to evaluate subregional groundwater flow and contaminant transport issues for assessing the cumulative risk to human health and the environment for downgradient receptors. The new data will then be used to identify the need and completion depths for additional wells in a phased approach.

Sampling requirements include:

- Drill/core the borehole from static water table to anticipated total depth of 1,500 ft below land surface obtaining the largest diameter core reasonably obtainable Document detailed core lithology in established controlled logbooks using guidance documents (TPR-6558).

- Collect vertical profile groundwater sample from the borehole at approximately 100-ft intervals. The zone to be sampled will be isolated, the zone will then be purged and samples will be taken. The field geologist on-site who is logging the borehole will determine the actual location of vertical profile groundwater sample collection. Vertical profile groundwater samples will be collected at locations based on stratigraphic breaks, such as interbeds, rubble zones, or major fractures as determined by the core logging.

- Purgewater will be measured and field parameters (temperature, pH, and specific conductance) will be recorded from the purgewater volumes until field parameters are stabilized and reasonable clarity of the purgewater has been achieved. Purgewater clarity will be determined by visual estimate or, if the field nephlometer is available, through nephlometric readings to a reasonably stabilized NTU reading. The groundwater samples will be collected after three borehole volumes have been purged if the field parameters have stabilized and reasonable purgewater clarity is achieved. If the field parameters have not stabilized and purgewater clarity has not been achieved after three borehole volumes, purging will continue until a total of five borehole volumes have been purged; then, groundwater samples will be collected regardless of field parameter stabilization or purgewater clarity.

- Measure and record depth-to-water at the start and end of sample event.

- Utilize and record results of CHEMetrics, Inc. field test kits for hexavalent chromium for each groundwater sample interval to detect hexavalent chromium in a concentration range as low as 0 to 50 ppm.

All other general and specific requirements for drilling and sampling this borehole are included in part 7 of the DQO table (see Table A2-1).

For managing the purgewater generated by this groundwater well purging, it is important that the field sampling team be fully aware of the WDDF purgewater management requirements for this scope based on information supplied to the team by the FTL before groundwater purging and sampling begins.

A4.1.3 Borehole Purging

Groundwter samples will be collected approximately every 100 feet or as determined by the FTL/Geologist. As each sampling zone is identified, the zone will be isolated and the water purged for a minimum of 3 volumes. If the water is not clear, as determined by visual or by a nephlometer if available, then a total of 5 volumes will be purged before the sample is collected.

During the purging operation, the field team will use the Hydrolab (DataSonde® or MiniSonde®) or an equivalent field instrument to measure the purgewater for specific conductance, pH, and temperature. If the system allows for measurement of oxidation reduction potential, then that data will also be collected. The field team will complete a functional check on the Hydrolab (or equivalent field instrument) per instructions in the manufacturers' manual. If there are extremes in temperature, the FTL may determine that a functional check should be performed more frequently. The factory-provided operating manual will be followed when using the Hydrolab DataSonde, MiniSonde, or equivalent field instrument.

Per TPR-6570, the field team will collect initial readings for specific conductance, pH, temperature, and flow rate just after purging begins and at regular intervals thereafter. All Hydrolab (or equivalent instrument) readings will be recorded on the well purging data form. The flow rate will be recorded in the WAG 10 groundwater sample logbook. There is also space on the purging data form to record readings for total dissolved solids (65% of the conductivity reading). The water parameter readings will provide a check on the stability of the water sampled over time.

Following purging and collection of field measurements in compliance with TPR-6570, groundwater samples will be collected. Table A4-1 outlines the specific requirements for containers, preservation methods, sample volumes, and holding times for these analyses. Special requirements for volatile organics are included in TPR-6570. The samples collected for metals analysis will be filtered or unfiltered during sample collection as specified in the SAP tables. The preferred order for water sample collection is covered in TPR-6570.

A4.1.4 Other Data Collection

As part of the collection of data from Middle 1823, additional characterization will be performed as follows:

1. The standard USGS geophysical suite will be completed in the borehole based on available access to the borehole. The suite will include natural gamma, gamma-gamma, neutron, caliper, video, and borehole deviation. The geophysical suite will be collected from the boreholeafter casing off the vadose zone

2. Depth to water measurements will be collectedbefore and after sampling to help define whether there is an upwelling or sinking head. The measurements will also be collected, at the end of the weekly shift, and again at the beginning of the weekly shift. All measurements will be recorded in the field logbook.

3. Groundwater parameters will be collected during each vertical profile groundwater sampling event to measure the quality of the water being sampled. These measurements will include pH, specific conductance, and temperature. Turbidity units on a field nephlometer will also be collected for water clarity if the nephlometer is available for use. The USGS is currently working on the calibration of their downhole flow meter. If the instrument is available for sample collection, these measurements will also be collected at the same time as the final geophysical suite run by the USGS. Other fluid logging could also include thermal and resistivity measurements.

4. Based on the availability of funding, additional tests will be conducted on representative samples of the core, primarily focusing on the material collected from interbeds and rubble zones. These additional tests may be completed at some future date based on available funding. These additional tests could include:

    - Grain size analysis
    - Saturated hydraulic conductivity
    - Petrographic analysis
    - Paleomagnetic measurements.

Table A4-1. Specific groundwater sample requirements for the TRA deep vertical borehole.

Analytical Parameter	Container Size	Container Type	Preservative	Holding Time[a]
Volatile organics (VOA[c]) (SW-846-8260B)	40 mL	3 × 40 mL glass vials w/teflon septa	4°C and H_2SO_4 to pH <2 no headspace	14 days
CLP list metals—filtered plus silica* and strontium* metal	1 L	2 × 1Liter G or P[d]	pH <2, HNO_3	180 days, Hg 28 days
Chromium, total, and hexavalent, unfiltered and filtered	1 L	2 × 1Liter G or P[d]	pH <2, HNO_3	180 days
Uranium-Total	1000 mL	4 × 1000 mL HDPE	pH <2, HNO_3	180 days
Nitrate (as nitrogen)	125 mL	1 × 125mL G or P	H_2SO_4 to pH <2	28 days[g]
Alkalinity* (total, hydroxide, carbonate, and bicarbonate)	500 mL	1 × 500 mL G or P	4°C	14 days
Anions* (chloride, fluoride, and sulfate)	125 mL	1 × 125 mL G or P	4°C	14 days
Tritium (H-3)	125 mL	1 HDPE	None	180 days
Gamma spectroscopy analysis	1000 mL	4 × 1000 mL HDPE	pH <2, HNO_3	180 days
Gross alpha/beta; Sr-90; Am-241	1 L	4 × 1 Liter HDPE	pH <2, HNO_3	180 days
Tc-99	1 L	HDPE	HNO_3 to pH <2	180 days
I-129	1 L	4 × 1 Liter amber glass or HDPE	None	28 days[e] 180 days[f]

a. Holding times are from date of collection as referred to in Federal Register Vol. 49, No. 209, October 26, 1984.

b. Collection to extraction: 7 days, extraction to analysis: 40 days

c. VOA = volatile organic analysis

d. G or P = glass or plastic

e. 28 days in high-density polyethylene (HDPE)

f. 180 days in amber glass

g. Holding time per "Methods for Chemical Analysis of Water and Wastes," Environmental Protection Agency-600/4-79-020, March, 1983, page xix

* = Analysis for samples collected from the vertical profile boreholes only. Not part of the sitewide groundwater sampling program.

Aqueous organics: need to collect one sample in triplicate volume for each analysis

A4.1.5 Reporting of Field Measurements and Copies of Logbooks

Following completion of groundwater water level measurements and the collection of groundwater monitoring and sampling, the results of the field work will be forwarded weekly to the project representative. The information should include the results of all measurements. Copies of the groundwater sample logbook pages that detail the field work completed for this groundwater sampling activity will also be forwarded to the WAG 10 Project Manager following the completion of the field sampling event.

A5. HANDLING AND DISPOSITION OF INVESTIGATION DERIVED WASTE

All waste dispositioning will be coordinated with the appropriate WGS interface to ensure compliance with applicable waste storage, characterization, treatment, and disposal requirements.

The investigation-derived waste (IDW) produced during sampling will include spent and unused sample material, PPE, miscellaneous sampling supplies, decontamination water, drill cutting, purgewater, and samples. WGS will provide a determination for the disposition of all waste, including drill cutting and purgewater that is based on a WDDF. The FTL will make copies of the sampling wells WDDFs available for review by the field sampling team. In addition to the WGS interface, Appendix G of the OU 10-08 RI/FS Work Plan (DOE-ID 2002) includes instructions for handling IDW for this project.

A5.1 Waste Identification and Disposition

Subsequent to generation, all of the waste will be classified. The waste streams that may be generated during the borehole sampling activity are not expected to be Resource Conservation and Recovery Act hazardous. However, chromium and tritium levels have been detected in groundwater wells in the surrounding area at low concentrations that may exceed the MCLs or derived concentration guides (DCGs) for these constituents. Subsequently, to ensure proper management of wastes generated during the borehole sampling activity, groundwater analysis results will be made available to WGS to make a waste determination as soon as possible, and will include, at a minimum analysis for chromium and tritium. The sample for tritium analysis will be shipped off-site for 24-hour turnaround on results from the tritium analysis. The requirements for sampling and analysis of tritium in the purgewater are specified in Table A5-1. Once the Snake River Plain Aquifer water table is reached during drilling, groundwater samples will be collected from the top of the water table and at approximately every 100 ft interval to depth of the drill/borehole.

Table A5-1. Specific purgewater sample and analysis requirements for tritium.

Analytical Parameter	PQL Required	Analytical Method	Container Size	Container Type	Preservative	Holding Time[a]
Tritium (H-3)	400 pCi/L	LSC[b]	125 mL	1 HDPE	None	180 days

a. Holding times are from date of collection as referred to in Federal Register Vol. 49, No. 209, October 26, 1984.

b. LSC = liquid scintillation counting.

Any drill cuttings and purgewater from the saturated zone generated during the drilling, coring, purging, and sampling will be containerized until field and analytical results are available and evaluated by WGS personnel. If the analytical results show levels below MCLs and DCGs for chromium and tritium, the drill cuttings may be spread over the ground and purgewater may be discharged to the ground. If the levels of chromium or tritium exceed the MCLs or DCGs, the purgewater and/or drill cuttings will require containerization and management. In this case, purgewater will be discharged to the TRA evaporation pond pending Waste Management Authority approval. Drill cuttings or other solid wastes will be dispositioned to the INTEC Staging and Storage Area pending disposal at the INEEL CERCLA Disposal Facility (ICDF).

Any sampling wastes or other solid waste from the saturated zone generated during drilling and coring operations will be containerized until analytical results from site characterization activities are received from the field screening and laboratory analysis. Solid wastes determined to be non-radioactive and non-hazardous will be dispositioned to the INEEL Landfill Complex. Any petroleum contaminated material (that is, soil, gravel, rock, plastic sheeting, and PPE) will be dispositioned to the INEEL Landfill Complex.

See Table A5-2 for a summary of potential waste types and disposition paths.

Table A5-2. Possible waste generation and disposition from sampling the TRA deep vertical profile borehole Middle 1823.

Waste Description	Waste Type	Disposition Pathway[a]	Appropriate WAC/Guidance
Administrative waste (paper products, office waste)	Industrial	INEEL Landfill Complex	RRWAC
Uncontaminated soil – drill cuttings generated from ground surface to the water table	N/A	Spread on the ground surface adjacent to the borehole location	N/A
Contaminated soil (that is, levels exceed MCLs or DCGs for chromium or tritium)	Low-level	ICDF Landfill	ICDF Landfill WAC
Uncontaminated purgewater	N/A	Spread on ground surface adjacent to the well location	N/A
Contaminated purgewater (that is, levels exceed MCLs or DCGs for chromium or tritium)	Low-level	Discharge to the TRA Evaporation Pond	TRA WMP has an approved profile
Uncontaminated PPE (gloves, boots, shoe covers, coveralls, and so forth)	Industrial	INEEL Landfill Complex	RRWAC
Contaminated PPE (gloves, boots, shoe covers, coveralls, and so forth)	Low-level	ICDF Landfill	ICDF landfill WAC or off-site WAC
Uncontaminated sampling wastes (wipes, spoons, and so forth)	Industrial	INEEL Landfill	RRWAC
Contaminated sampling wastes (wipes, spoons, and so forth)	Low-level	ICDF Landfill	ICDF landfill WAC or off-site WAC
Liquid and solid decontamination residues	Industrial, low-level	INEEL Landfill, ICDF Landfill	RRWAC, ICDF landfill WAC, or off-site WAC
Petroleum-contaminated media (that is, soil, plastic sheeting, and PPE from hydraulic fluid spills)	Industrial	INEEL Landfill Complex	RRWAC

Table A5-2. (continued).

Waste Description	Waste Type	Disposition Pathway[a]	Appropriate WAC/Guidance
Contaminated equipment that cannot be decontaminated	Low-level	ICDF Landfill	ICDF landfill WAC or off-site WAC
Maintenance-related wastes (from vehicles, equipment, facilities, and so forth)	Industrial	INEEL Landfill Complex	RRWAC
Miscellaneous waste (for example, tools, debris, equipment, metal/plastic pipe, plastic sheeting, and so forth)	Industrial	INEEL Landfill Complex, ICDF Landfill	RRWAC, ICDF landfill WAC

a. In the event on-site disposal is not available, off-site disposal options may be pursued.

A6. CRITICAL SAMPLES

The critical samples will be the analysis of groundwater samples for COPC constituents listed in Table A2-2 to establish potential risk and action levels. The analyses listed in Table A2-2 as Additional Analyses are for scientific inquiry and to provide information for the INEEL-wide groundwater model, but are not critical samples.

A7. REFERENCES

40 CFR 261, 2001, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations,* Office of the Federal Register, July 2001.

49 CFR Part 171, 2000, "General Information, Regulations, and Definitions," *Code of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 172, 2000, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements, *Code of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 173, 2000, "Shippers--General Requirements for Shipments and Packagings," *Code of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 174, 2000, "Carriage by Rail," *Code of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 175, 2000, "Carriage by Aircraft," C*ode of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 176, 2000, "Carriage by Vessel," *Code of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 177, 2000, "Carriage by Public Highway," *Code of Federal Regulations,* Office of the Federal Register, October 2000.

49 CFR Part 178, 2000, "Specifications for Packagings," *Code of Federal Regulations,* Office of the Federal Register, October 2000.

54 FR 29820, 1989, "National Priorities List for Uncontrolled Hazardous Waste Sites," *Federal Register,* United States Environmental Protection Agency, pp. 29820-29825, July 14, 1989.

Bowman, A. L., W. F. Downs, K. S. Moor, and B. F. Russell, 1984, *INEL Environmental Characterization Report*, Vol. 2, EGG-NPR-6688, September 1984.

DOE-ID, 1999, Work Plan for Waste Area Groups (WAGs) 6 and 10, Operable Unit 10-04 Comprehensive Remedial Investigation/Feasibility Study (RI/FS), DOE/ID-10554, Rev. 0, April 1999.

DOE-ID, 2001, "Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites," DOE/ID-10587, Rev. 7, 2001.

DOE-ID, 2002, "WAG 10, OU 10-08, Comprehensive Remedial Investigation/Feasibility Study Work Plan," DOE/ID-10902, Rev. 0, March 2002.

EPA, 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA,* Interim Final, EPA.540.G-89/004, 1988.

EPA, 1983, *Methods for Chemical Analysis of Water and Wastes,* EPA-600/4-79-020, March 1983.

GDE-7003, "Levels of Analytical Method Data Validation," March 2001.

INEEL, 2002, "Field Sampling Plan for Groundwater Monitoring Under Operable Unit 10-08 for Fiscal Years 2002, 2003, and 2004, Rev. 2, INEEL/EXT-01-01529, 2002.

INEEL, 2002a, "Health and Safety Plan for the Environmental Restoration Long-Term Stewardship Sitewide Groundwater Monitoring, Rev 0, INEEL/EXT-01-01644, 2002.

INEL, 1991, *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory*, December 1991.

INEL, 1995, *INEL Statement of Work for Organic Analyses Performed for the INEL Sample Management Office,* ER-SOW-156, Rev. 1, April 1995

MCP-135, "Creating, Modifying, and Canceling Procedures and Other DMCS-Controlled Documents," Rev. 12, General Administration and Information Management, May 2002.

MCP-244, "Chain of Custody, Sample Handling, and Packaging for CERCLA Activities," Rev. 4, Environmental Restoration, April 2002.

MCP-2725, "Field Work and the INEEL," Rev. 3, Safety and Fire Protection, January 2001.

MCP-3003, "Performing Pre-Job Briefings and Documenting Feedback," Rev. 10, Operations, October 2002.

TPR-80, "Radioanalytical Data Validation," May 1997.

TPR-4910, "Logbook Practices for ER and D&D&D Projects," May 2002.

TPR-4913, "Chain of Custody and Sample Labeling for ER and D&D&D Projects," July 2002.

TPR-5084, "Handling, Storage and Shipping," March 2002.

TPR-6541, "Decontaminating Sampling Equipment," June 2001.

TPR-6566, "Measuring Groundwater Levels," November 2000.

TPR-6570, "Sampling Groundwater," October 2000.

TPR-6575, "Decontaminating Sampling Equipment in the Field," May 2001.

Appendix B

Sampling and Analysis Plan Tables

Plan Table Number: OU10-08_GW_FY03

SAP Number: INEEL/EXT-01-01529 REV 2

Date: 09/30/2002 Plan Table Revision: 0.0 Project: OU10-08 GROUND WATER NOVEMBER 2002 (FY-03 FIRST ROUND) Project Manager: HIARING, C M SMO Contact: MCGRIFF, T W

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																			
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
										AN	B9	CW	RI	MA	Q6	5X	RH	S1	EA	XX	R8	AV	AZ						
GWM020	REG	GROUND WATER	GRAB		11/11/02	INEELBOUNDARY	AQUIFER WELLS	USGS-001	588	1	1		1	1	1		1	1	1	1	1	1							
GWM021	REG	GROUND WATER	GRAB		11/11/02	INEELBOUNDARY	AQUIFER WELLS	USGS-009	607	1	1	1	1	1	1		1	1	1	1	1	1							
GWM022	REG	GROUND WATER	GRAB		11/11/02	INEELBOUNDARY	AQUIFER WELLS	USGS-086	649	1	1	1	1	1	1		1	1	1	1	1	1							
GWM023	REG	GROUND WATER	GRAB		11/11/02	INEELBOUNDARY	AQUIFER WELLS	USGS-101	771	1	1		1	1	1		1	1	1	1	1	1							
GWM024	REG	GROUND WATER	GRAB		11/11/02	INEELBOUNDARY	AQUIFER WELLS	USGS-103	583	1	1		1	1	1		1	1	1	1	1	1							
GWM025	REG	GROUND WATER	GRAB		11/11/02	INEELBOUNDARY	AQUIFER WELLS	USGS-105	670	1	1	1	1	1	1		1	1	1	1	1	1							
GWM026	REG	GROUND WATER	GRAB		11/11/02	INEELBOUNDARY	AQUIFER WELLS	USGS-108	609	1	1		1	1	1		1	1	1	1	1	1							
GWM027	REG/QC	GROUND WATER	DUP		11/11/02	INEELBOUNDARY	AQUIFER WELLS	USGS-109	621	1	1	2	1	1	1		1	1	1	1	1	1							
GWM028	REG	GROUND WATER	GRAB		11/11/02	INEELBOUNDARY	AQUIFER WELLS	USGS-110	566	1	1		1	1	1		1	1	1	1	1		1						
GWM029	REG/QC	GROUND WATER	DUP		11/11/02	INEELBOUNDARY	AQUIFER WELLS	HIGHWAY 2	725	2	2		2	2	2		2	2	2	2	2	2							
GWM030	REG	GROUND WATER	GRAB		11/11/02	GUARD WELLS	AQUIFER WELLS	USGS-002	659	1	1		1	1	1		1	1	1	1	1	1							
GWM031	REG	GROUND WATER	GRAB		11/11/02	GUARD WELLS	AQUIFER WELLS	USGS-104	555	1	1		1	1	1		1	1	1	1	1	1							
GWM032	REG	GROUND WATER	GRAB		11/11/02	GUARD WELLS	AQUIFER WELLS	MP2	TBD													1							
GWM033	REG	GROUND WATER	GRAB		11/11/02	GUARD WELLS	AQUIFER WELLS	MP2	TBD	1				1	1					1									
GWM034	REG	GROUND WATER	GRAB		11/11/02	GUARD WELLS	AQUIFER WELLS	MP2	TBD				1				1				1								

The sampling activity displayed on this table represents the first six characters of the sample identification number. The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: Anions
AT2: Bicarbonate
AT3: C-14
AT4: Iodine-129
AT5: Major Cations
AT6: Nitrate (as Nitrogen)
AT7: Nitroaromatics (8330) MS/MSD
AT8: Radiochemistry - Suite 1
AT9: Silica
AT10: Tc-99

AT11: Total Metals - Filtered
AT12: Tritium
AT13: VOCs (Appendix IX TAL)
AT14: VOCs (Appendix IX TAL) - MS/MSD
AT15:
AT16:
AT17:
AT18:
AT19:
AT20:

Comments:

Nitroaromatics (8330) = RDX, TNT

Total Metals = CLP TAL plus strontium. The total metals contaminants of potential concern (COPCs) are: arsenic, beryllium, cadmium, chromium, lead, mercury, and zinc

Major Cations defined as sodium, potassium, magnesium, and calcium

Anions defined as chloride, sulfate, and fluoride

Analysis Suites:

Radiochemistry - Suite 1: Gross Alpha, Gross Beta, Gamma Spec, U-Iso, Sr-90

Contingencies:

Plan Table Number: OU10-08_GW_FY03

SAP Number: INEEL/EXT-01-01529 REV 2.

Date: 09/30/2002 Plan Table Revision: 0.0 Project: OU10-08 GROUND WATER, NOVEMBER 2002 (FY-03 FIRST ROUND) Project Manager: HIARING, C. M. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																			
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	AN	B9	CW	RI	MA	Q6	5X	RH	S1	EA	XX	R8	AV	AZ						
GWM035	REG	GROUND WATER	GRAB		11/11/02	GUARD WELLS	AQUIFER WELLS	USGS-106	584	1	1		1	1	1		1	1	1	1	1	1							
GWM036	REG	GROUND WATER	GRAB		11/11/02	GUARD WELLS	AQUIFER WELLS	USGS-107	477	1	1		1	1	1		1	1	1	1	1	1							
GWM037	REG/QC	GROUND WATER	DUP		11/11/02	GUARD WELLS	AQUIFER WELLS	HIGHWAY 3	538	1	1		1	1	1	2	1	1	1	1	1	1							
GWM038	REG	GROUND WATER	GRAB		11/11/02	BASELINE WELLS	AQUIFER WELLS	USGS-004	251	1	1		1	1	1		1	1	1	1	1	1							
GWM039	REG	GROUND WATER	GRAB		11/11/02	BASELINE WELLS	AQUIFER WELLS	USGS-008	766	1	1		1	1	1		1	1	1	1	1	1							
GWM040	REG	GROUND WATER	GRAB		11/11/02	BASELINE WELLS	AQUIFER WELLS	USGS-019	276	1	1		1	1	1		1	1	1	1	1		1						
GWM041	REG	GROUND WATER	GRAB		11/11/02	BASELINE WELLS	AQUIFER WELLS	USGS-025	272	1	1		1	1	1		1	1	1	1	1	1							
GWM042	REG	GROUND WATER	GRAB		11/11/02	BASELINE WELLS	AQUIFER WELLS	USGS-026	212	1	1		1	1	1		1	1	1	1	1	1							
GWM043	REG/QC	GROUND WATER	DUP		11/11/02	BASELINE WELLS	AQUIFER WELLS	USGS-027	228	2	2		2	2	2		2	2	2	2	2	2							
GWM044	REG	GROUND WATER	GRAB		11/11/02	BASELINE WELLS	AQUIFER WELLS	DH-1B	268	1	1		1	1	1		1	1	1	1	1	1							
GWM045	REG	GROUND WATER	GRAB		11/11/02	BASELINE WELLS	AQUIFER WELLS	P&W-3	304	1	1		1	1	1		1	1	1	1	1	1							
GWM046	QC	WATER	FBLK		11/11/02	INEEL	FIELD BLANK	QC	NA	1	1		1	1	1		1	1	1	1	1	1							
GWM047	QC	WATER	FBLK		11/11/02	INEEL	FIELD BLANK	QC	NA	1	1		1	1	1		1	1	1	1	1	1							
GWM048	QC	WATER	FBLK		11/11/02	INEEL	FIELD BLANK	QC	NA	1	1		1	1	1		1	1	1	1	1	1							
GWM049	QC	WATER	TBLK		11/11/02	INEEL	TRIP BLANK	QC	NA													1							

The sampling activity displayed on this table represents the first six characters of the sample identification number. The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: Anions
AT2: Bicarbonate
AT3: C-14
AT4: Iodine-129
AT5: Major Cations
AT6: Nitrate (as Nitrogen)
AT7: Nitroaromatics (8330) MS/MSD
AT8: Radiochemistry - Suite 1
AT9: Silica
AT10: Tc-99

AT11: Total Metals - Filtered
AT12: Tritium
AT13: VOCs (Appendix IX TAL)
AT14: VOCs (Appendix IX TAL) - MS/MSD
AT15:
AT16:
AT17:
AT18:
AT19:
AT20:

Comments:
Nitroaromatics (8330) = RDX, TNT

Total Metals = CLP TAL plus strontium. The total metals contaminants of potential concern (COPCs) are: arsenic, beryllium, cadmium, chromium, lead, mercury, and zinc

Major Cations defined as sodium, potassium, magnesium, and calcium

Anions defined as chloride, sulfate, and fluoride

Analysis Suites:
Radiochemistry - Suite 1: Gross Alpha, Gross Beta, Gamma Spec, U-iso, Sr-90

Contingencies:

Plan Table Number: OU10-08_GW_FY03

SAP Number: INEEL/EXT-01-01529 REV 2.

Date: 09/30/2002 Plan Table Revision: 0.0 Project: OU10-08 GROUND WATER, NOVEMBER 2002 (FY-03 FIRST ROUND) Project Manager: HIARING, C. M. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																			
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	AT1 AN	AT2 B9	AT3 CW	AT4 RI	AT5 MA	AT6 Q6	AT7 5X	AT8 RH	AT9 S1	AT10 EA	AT11 XX	AT12 R8	AT13 AV	AT14 AZ	AT15	AT16	AT17	AT18	AT19	AT20
GWM050	QC	WATER	TBLK		11/11/02	INEEL	TRIP BLANK	QC	NA													1							
GWM051	QC	WATER	TBLK		11/11/02	INEEL	TRIP BLANK	QC	NA													1							
GWM052	QC	WATER	TBLK		11/11/02	INEEL	TRIP BLANK	QC	NA													1							
GWM053	QC	WATER	TBLK		11/11/02	INEEL	TRIP BLANK	QC	NA													1							
GWM054	QC	WATER	TBLK		11/11/02	INEEL	TRIP BLANK	QC	NA													1							
GWM055	QC	WATER	TBLK		11/11/02	INEEL	TRIP BLANK	QC	NA													1							
GWM056	QC	WATER	TBLK		11/11/02	INEEL	TRIP BLANK	QC	NA													1							
GWM057	QC	WATER	TBLK		11/11/02	INEEL	TRIP BLANK	QC	NA													1							
GWM058	QC	WATER	TBLK		11/11/02	INEEL	TRIP BLANK	QC	NA													1							
GWM059	QC	WATER	TBLK		11/11/02	INEEL	TRIP BLANK	QC	NA													1							

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The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: Anions
AT2: Bicarbonate
AT3: C-14
AT4: Iodine-129
AT5: Major Cations
AT6: Nitrate (as Nitrogen)
AT7: Nitroaromatics (8330) MS/MSD
AT8: Radiochemistry - Suite 1
AT9: Silica
AT10: Tc-99

AT11: Total Metals - Filtered
AT12: Tritium
AT13: VOCs (Appendix IX TAL)
AT14: VOCs (Appendix IX TAL) - MS/MSD
AT15:
AT16:
AT17:
AT18:
AT19:
AT20:

Comments:

Nitroaromatics (8330) = RDX, TNT

Total Metals = CLP TAL plus strontium. The total metals contaminants of potential concern (COPCs) are: arsenic, beryllium, cadmium, chromium, lead, mercury, and zinc

Major Cations defined as sodium, potassium, magnesium, and calcium

Anions defined as chloride, sulfate, and fluoride

Analysis Suites:

Radiochemistry - Suite 1: Gross Alpha, Gross Beta, Gamma Spec, U-Iso, Sr-90

Contingencies:

Plan Table Number: DEEPPROFILEWELL

SAP Number: INEEL/EXT-01-01529

Date: 10/17/2002 Plan Table Revision: 0.0 Project: OU10-08 CORE HOLE Project Manager: HIARING, C. M. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																			
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	A1	AN	5C	CU	CR	RI	Q6	P2	RH	EA	LF	R8	AV	AZ						
GWM220	REG	GROUND WATER	GRAB		11/08/2002	GUARD WELL	MIDDLE COREHOLE	MIDDLE-1823	580	1	1	1	1	1	1	1	1	1	1	1	1	1							
GWM221	REG	GROUND WATER	GRAB		11/08/2002	GUARD WELL	MIDDLE COREHOLE	MIDDLE-1823	680	1	1	1	1	1	1	1	1	1	1	1	1		1						
GWM222	REG	GROUND WATER	GRAB		11/08/2002	GUARD WELL	MIDDLE COREHOLE	MIDDLE-1823	780	1	1	1	1	1	1	1	1	1	1	1	1	1							
GWM223	REG	GROUND WATER	GRAB		11/08/2002	GUARD WELL	MIDDLE COREHOLE	MIDDLE-1823	880	1	1	1	1	1	1	1	1	1	1	1	1		1						
GWM224	REG/QC	GROUND WATER	DUP		11/08/2002	GUARD WELL	MIDDLE COREHOLE	MIDDLE-1823	980	2	2	2	2	2	2	2	2	2	2	2	2	2							
GWM225	REG	GROUND WATER	GRAB		11/08/2002	GUARD WELL	MIDDLE COREHOLE	MIDDLE-1823	1080	1	1	1	1	1	1	1	1	1	1	1	1		1						
GWM226	REG	GROUND WATER	GRAB		11/08/2002	GUARD WELL	MIDDLE COREHOLE	MIDDLE-1823	1180	1	1	1	1	1	1	1	1	1	1	1	1	1							
GWM227	REG	GROUND WATER	GRAB		11/08/2002	GUARD WELL	MIDDLE COREHOLE	MIDDLE-1823	1280	1	1	1	1	1	1	1	1	1	1	1	1		1						
GWM228	REG	GROUND WATER	GRAB		11/08/2002	GUARD WELL	MIDDLE COREHOLE	MIDDLE-1823	1380	1	1	1	1	1	1	1	1	1	1	1	1	1							
GWM229	REG	GROUND WATER	GRAB		11/08/2002	GUARD WELL	MIDDLE COREHOLE	MIDDLE-1823	1480	1	1	1	1	1	1	1	1	1	1	1	1		1						
GWM230	QC	WATER	TBLK		11/08/2002	INEEL	TRIP BLANK	QC	NA													1							
GWM231	QC	WATER	FBLK		11/08/2002	INEEL	FIELD BLANK	QC	NA	1	1	1	1	1	1	1	1	1	1	1	1	1							
GWM232	QC	WATER	TBLK		11/08/2002	INEEL	TRIP BLANK	QC	NA													1							
GWM233	QC	WATER	TBLK		11/08/2002	INEEL	TRIP BLANK	QC	NA													1							
GWM234	QC	WATER	TBLK		11/08/2002	INEEL	TRIP BLANK	QC	NA													1							

The sampling activity displayed on this table represents the first six characters of the sample identification number.

The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: Alkalinity

AT2: Anions

AT3: Chromium

AT4: Chromium - Filtered

AT5: Chromium VI (Cr+6)

AT6: Iodine-129

AT7: Nitrate (as Nitrogen)

AT8: Phosphorus

AT9: Radiochemistry - Suite 1

AT10: Tc-99

AT11: Total Metals (CLP TAL) - Filtered

AT12: Tritium

AT13: VOCs (Appendix IX TAL)

AT14: VOCs (Appendix IX TAL) - MS/MSD

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

anions include: bromide, chloride, fluoride, nitrate-N, nitrite-N, sulfate, and ortho-phosphate-P

CLP metals include: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, lead, iron, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc

Silica and strontium shall be requested in addition to the CLP metals list

Chromium (AT3, code 5C) defined as total Cr

Chromium - Filtered (AT4, code CU) defined as Cr VI (Cr+6)

Chromium VI (Cr+6) defined as unfiltered Cr VI (Cr+6)

Analysis Suites:

Radiochemistry - Suite 1: Gross Alpha, Gross Beta, Gamma Spec, U-Iso, Sr-90

Contingencies:

Sampling and Analysis Plan Table for Chemical and Radiological Analysis

Plan Table Number: OU10-08_TRITIUM

SAP Number:

Date: 11/11/2002 Plan Table Revision: 1.0 Project: TRA DEEP WELL DRILLING, CORING WELL INSTALLATION PROJECT, OU Project Manager: HIARING, C. M. SMO Contact: KIRCHNER, D. R.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																			
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
										R8																			
TRA016	REG	GROUND WATER	GRAB		11/11/2002	TRA	CORE HOLE	MIDDLE-1823	TBD	1																			
TRA017	REG	GROUND WATER	GRAB		11/11/2002	TRA	CORE HOLE	MIDDLE-1823	TBD	1																			
TRA018	REG	GROUND WATER	GRAB		11/11/2002	TRA	CORE HOLE	MIDDLE-1823	TBD	1																			
TRA019	REG	GROUND WATER	GRAB		11/11/2002	TRA	CORE HOLE	MIDDLE-1823	TBD	1																			
TRA020	REG	GROUND WATER	GRAB		11/11/2002	TRA	CORE HOLE	MIDDLE-1823	TBD	1																			
TRA021	REG	GROUND WATER	GRAB		11/11/2002	TRA	CORE HOLE	MIDDLE-1823	TBD	1																			
TRA022	REG	GROUND WATER	GRAB		11/11/2002	TRA	CORE HOLE	MIDDLE-1823	TBD	1																			
TRA023	REG/QC	GROUND WATER	DUP		11/11/2002	TRA	CORE HOLE	MIDDLE-1823	TBD	2																			
TRA024	REG	GROUND WATER	GRAB		11/11/2002	TRA	CORE HOLE	MIDDLE-1823	TBD	1																			
TRA025	REG	GROUND WATER	GRAB		11/11/2002	TRA	CORE HOLE	MIDDLE-1823	TBD	1																			
TRA026	REG	GROUND WATER	GRAB		11/11/2002	TRA	CORE HOLE	MIDDLE-1823	TBD	1																			
TRA027	REG	GROUND WATER	GRAB		11/11/2002	TRA	CORE HOLE	MIDDLE-1823	TBD	1																			

The sampling activity displayed on this table represents the first six characters of the sample identification number.

The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: Tritium
AT2:
AT3:
AT4:
AT5:
AT6:
AT7:
AT8:
AT9:
AT10:

AT11:
AT12:
AT13:
AT14:
AT15:
AT16:
AT17:
AT18:
AT19:
AT20:

Comments:
A tritium sample will be collected each time a vertical profile sample is collected

Samples must be shipped immediately in order for the lab to meet the required 24-hour turnaround time

Analysis Suites:

Contingencies:

Appendix C

Addition to DQOs—Implementation Plan for Drilling

Appendix C

Addition to DQOs—Implementation Plan for Drilling

C1. INTRODUCTION

This project includes drilling and constructing one aquifer monitoring well and one core hole. The core hole will be located approximately 3/4 mile southwest of the TRA facility. The depth and location of the monitoring well will be based on the preliminary analytical, geologic, and hydrologic results of the core hole.

C2. CORE HOLE SCOPE

This section describes the proposed method for drilling and collecting the vertical profile samples in the core hole. Field conditions may require a different methodology to successfully meet the objectives of this project. Using a rotary drill rig with a hammer, 15.25-in. (nominal) hammer bit, 7-in. (nominal) dual wall drill rods, and 16-in. (nominal) DR casing, a bore hole will be drilled through the surficial sediments and into the competent basalt or a minimum of 18 ft bls. A borehole will be drilled (12.5-in. nominal borehole) from the bottom of the surface casing to 20 to 30 ft into the regional aquifer. Temporary 6-in. casing is installed to the bottom of the rotary borehole. Using a core rig, the core hole will be continuously cored from that point to 1500 ft bls. Beginning at a point equal to the depth of the borehole, water samples will be taken approximately every 100 ft using an in-line packer system and pump. The cores will be evaluated to determine the best locations in the core hole to extract a water sample. The core bit and rod will be pulled back to expose permeable zones in the aquifer and to a location where an adequate seal can be ensured between the packer and the side of the borehole. The bottom of the borehole for each progression will be assumed to be a hydrologic barrier. The packer system proposed for this application is a dual packer system with a 4-in. submersible pump capable of pumping 8 to 12 gpm. The lower packer will seal off the borehole below the bottom of the core bit. The upper packer will seal off the inside of the core rods, with the 4-in. pump being inside the rods but between the packers. The portion of the aquifer between the lower packer and the bottom of the borehole will be purged at least 3 volumes to ensure formation water is being sampled. The core will be 134-mm wireline Geobarrel system. All core will be saved and boxed. The drill cuttings from the vadose zone will be collected approximately every 5 ft and at every change in lithology. In the event that difficult subsurface conditions prevent coring using the 134-mm Geobarrel system, an "HQ" size core will be advanced through the core rods and coring will continue. A smaller sized packer system may then be deployed using a positive displacement pump to collect the water samples for the vertical profile.

During the coring process, static water levels will be measured using an E-line to help determine vertical gradients in the aquifer. Since water will be added during the coring process, the measurements will be taken after the dual packer and pump system are removed from the well for each sampling event. When total depth is achieved, a natural gamma log will be run through the 134-mm rods prior to removing the core rods and bit.

The core hole will be left open for approximately 1 month for other subsurface science tasks to be performed. After this period of testing, if cleaning of the well is needed and possible, a 1500-ft 2-in. diameter stainless steel pipe with a 20-ft screen on the bottom could be installed in the core hole. The decision may be made to abandon the core hole portion of the boring, install a 6-in. stainless steel screen and casing to a depth of approximately 500 ft bls. A dedicated submersible pump could then be installed to produce a shallow monitoring well in this location. This decision will be based on results from the core, analytical results, and the stability of the core hole. For instance, if tritium or another contaminant prevalent in the injection well is present in the upper portion of the aquifer, and not at depth, the decision to put make this boring a shallow monitoring well would make sense. Also, if the core hole is unstable and a 2-in. stainless steel pipe cannot be installed, then it may be cost effective to make the borehole a shallow monitoring well. If the core hole can be easily cleaned, it may be feasible to install the 2-in. stainless steel pipe inside the drill/core rods and build the well as the rods are removed.

C3. MONITORING WELL CONSTRUCTION

The monitoring well will be constructed to collect aquifer samples from the regional aquifer. The casing will be 6-in. (nominal) stainless steel. The total depth of the well will be determined based on results from the vertical profile sample results from the deep core hole. The regional aquifer is approximately 475 ft bls. The monitoring well will be fitted with a dedicated submersible pump capable of producing approximately 8 to 12 gpm at the discharge point. The construction of the well will be dependent on the depth and the number of interbeds that may need to be sealed. The design for the well will be based on the results of the core and the geophysical logs.

Appendix D

Figures Showing the Monitoring Well Locations

Appendix D

Figures Showing the Monitoring Well Locations

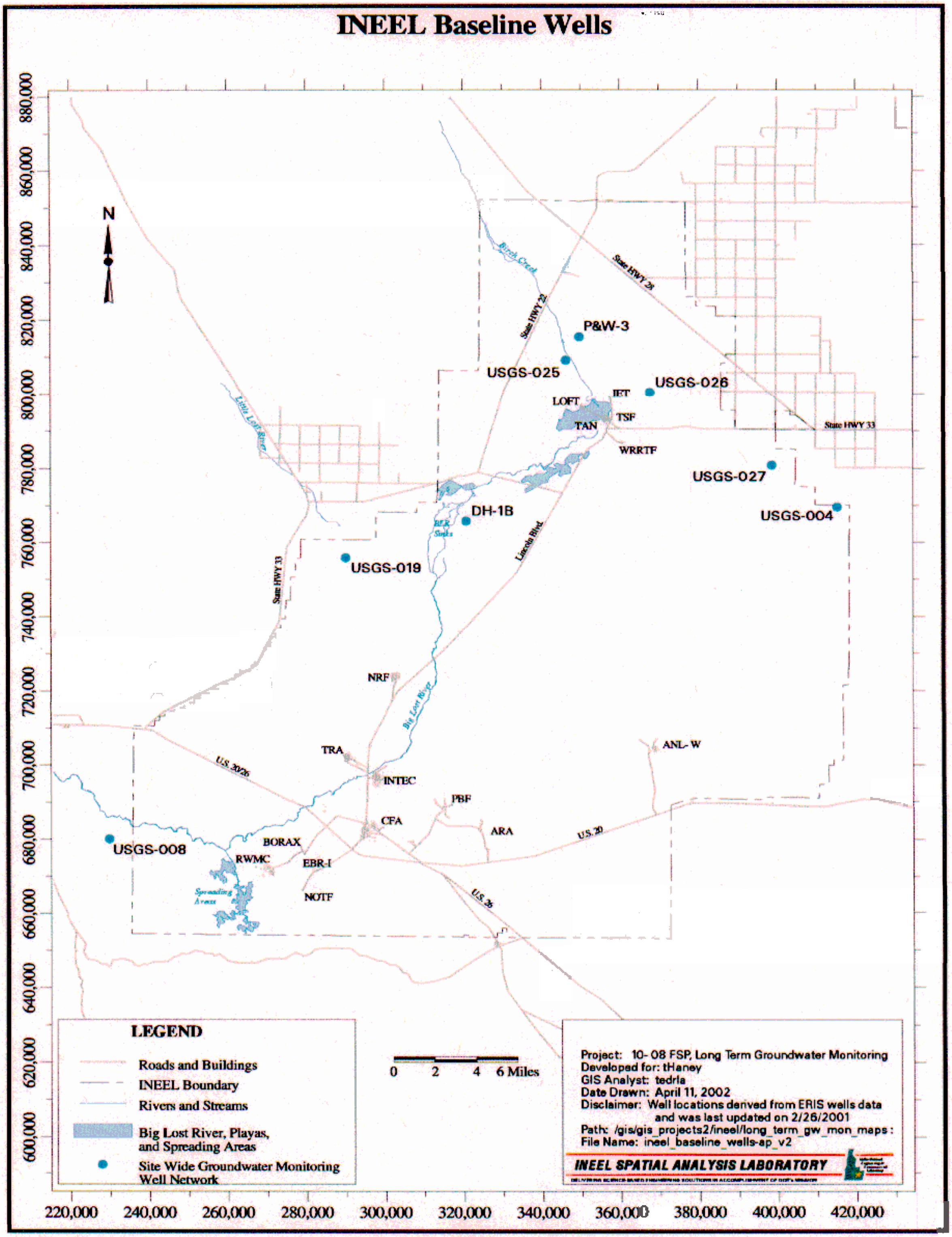

Figure D-1. INEEL baseline wells.

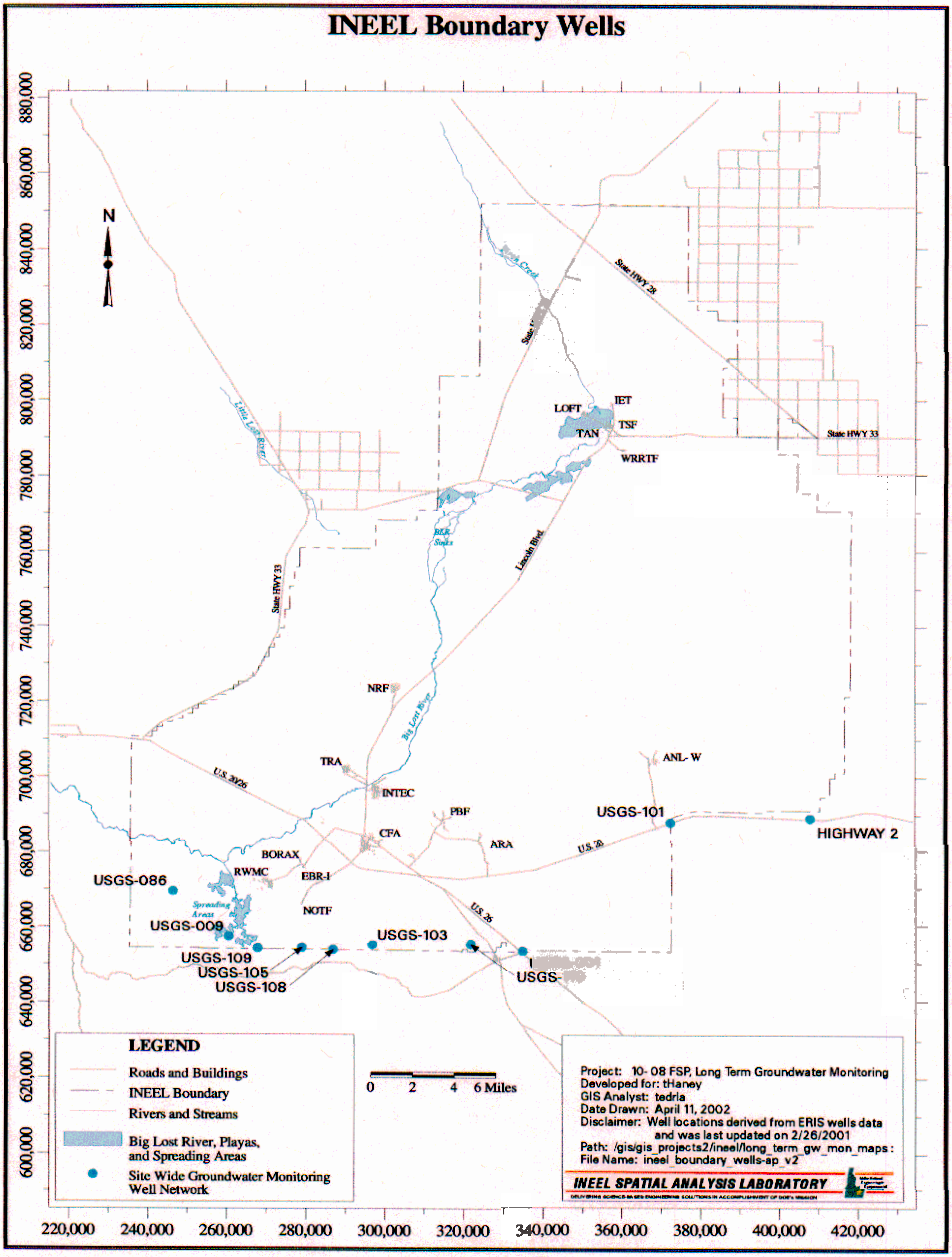

Figure D-2. INEEL boundary wells.

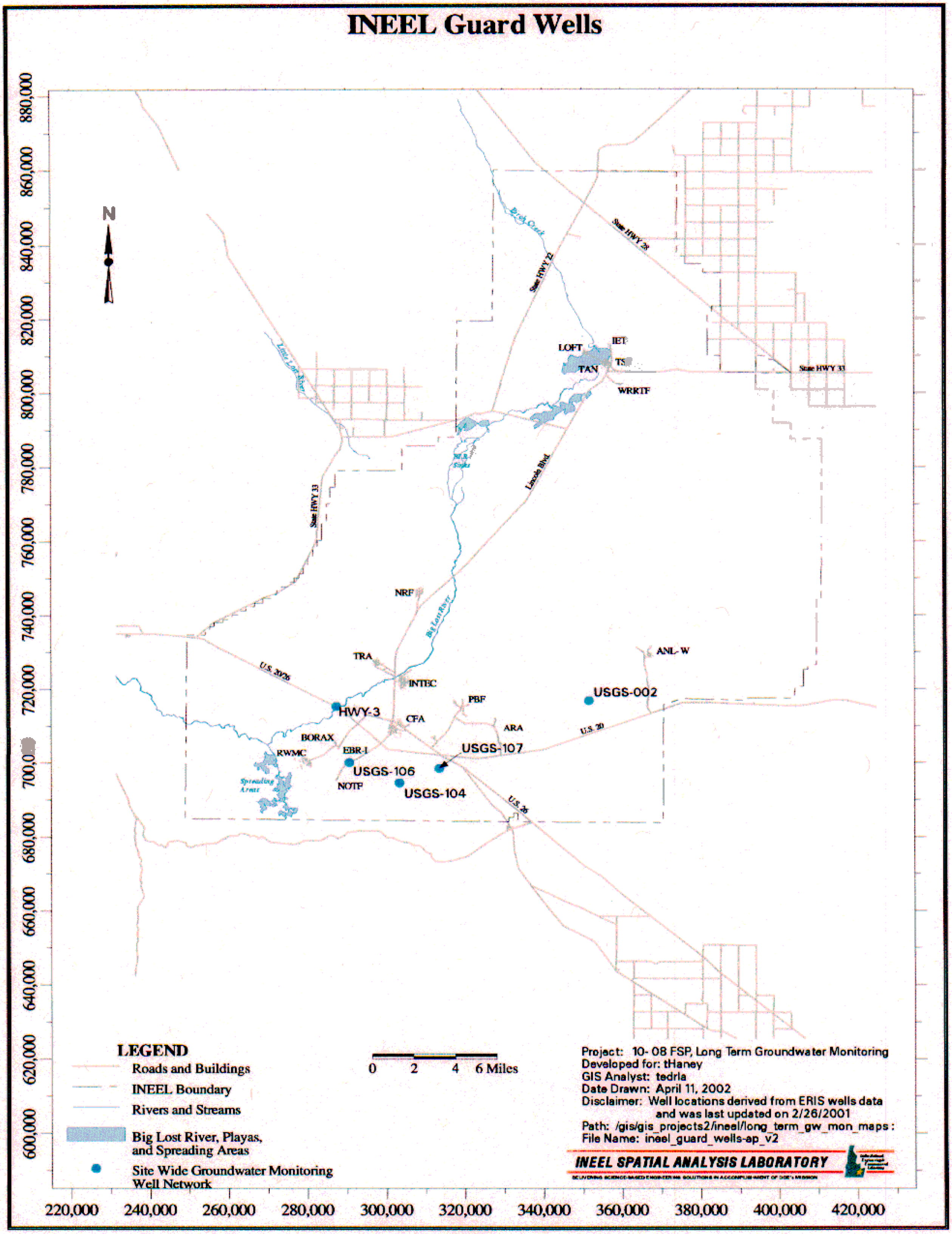

Figure D-3. INEEL guard wells.